SCIENTIFIC AMERICAN

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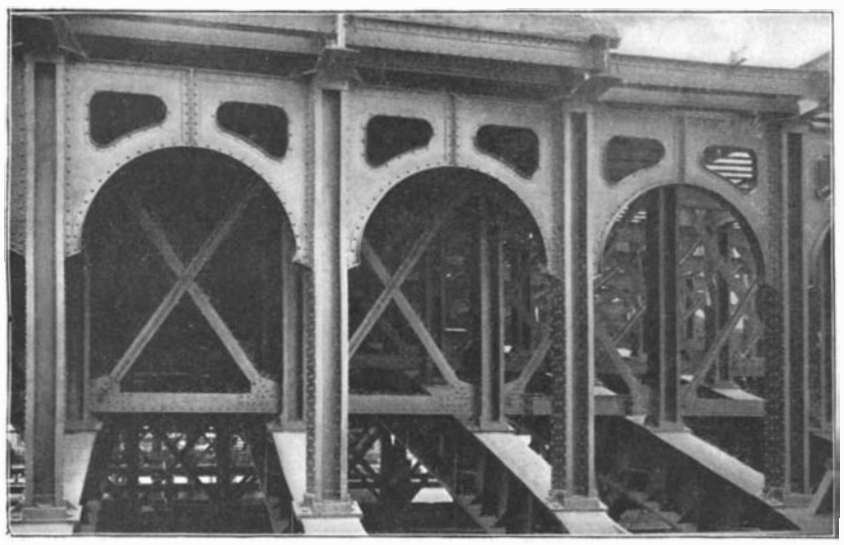
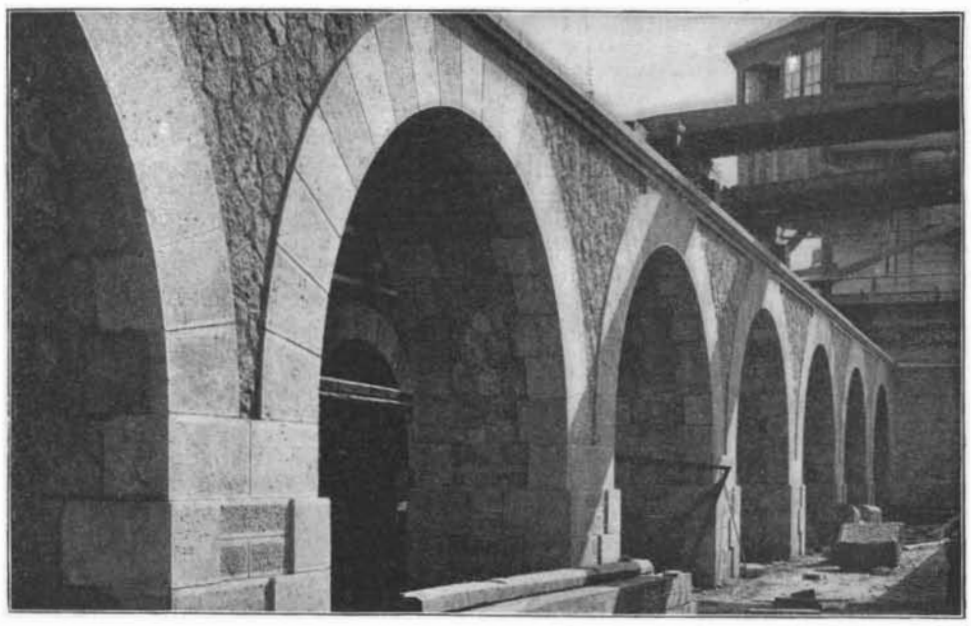
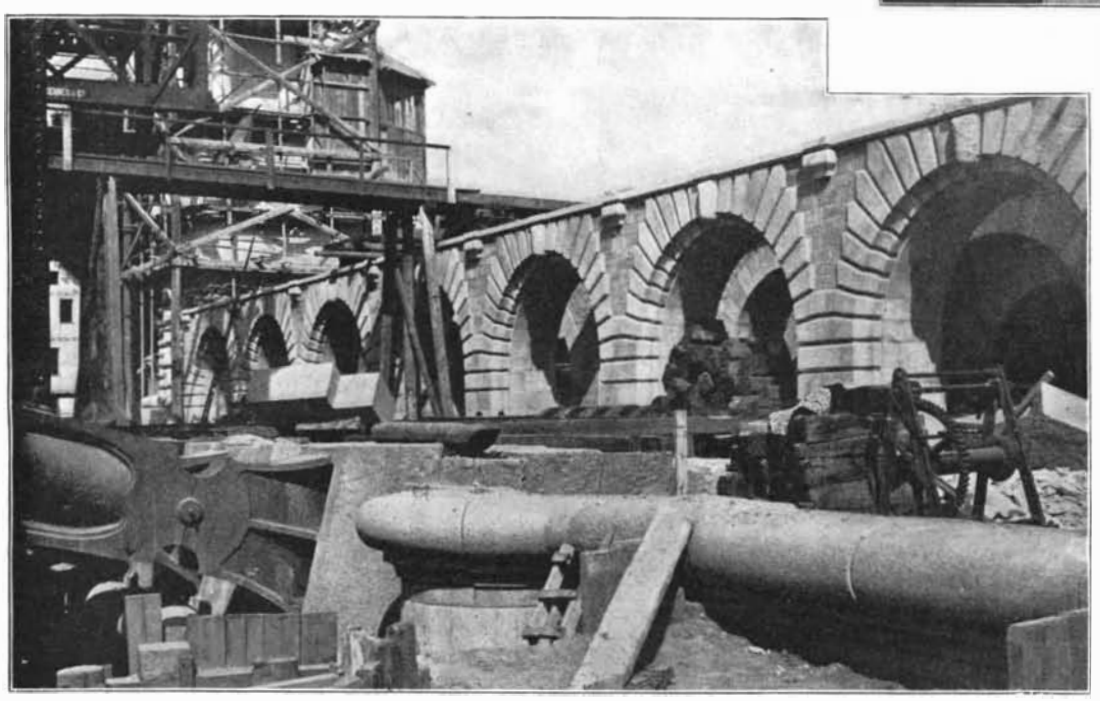


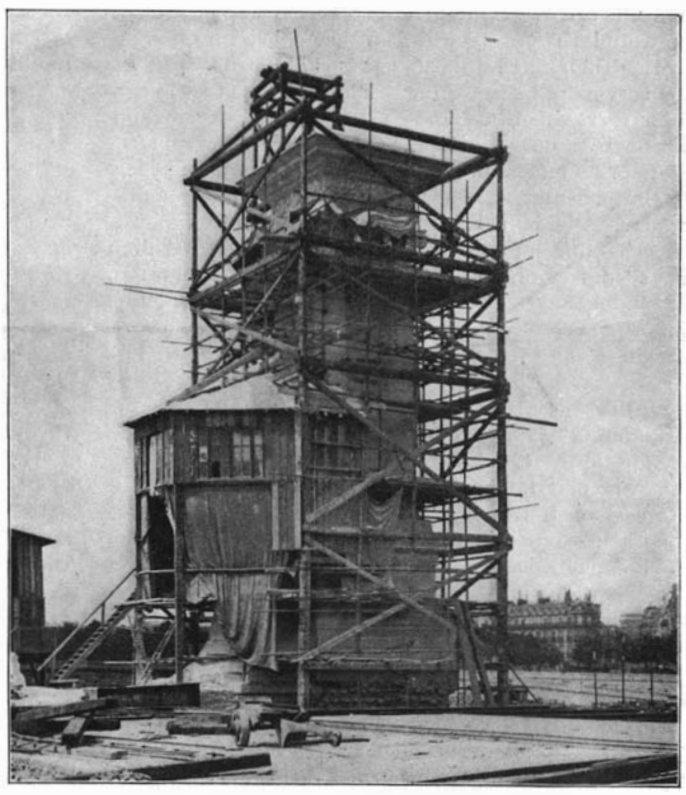
View Along Axis of Bridge, Showing Vertical Posts and Bracing.



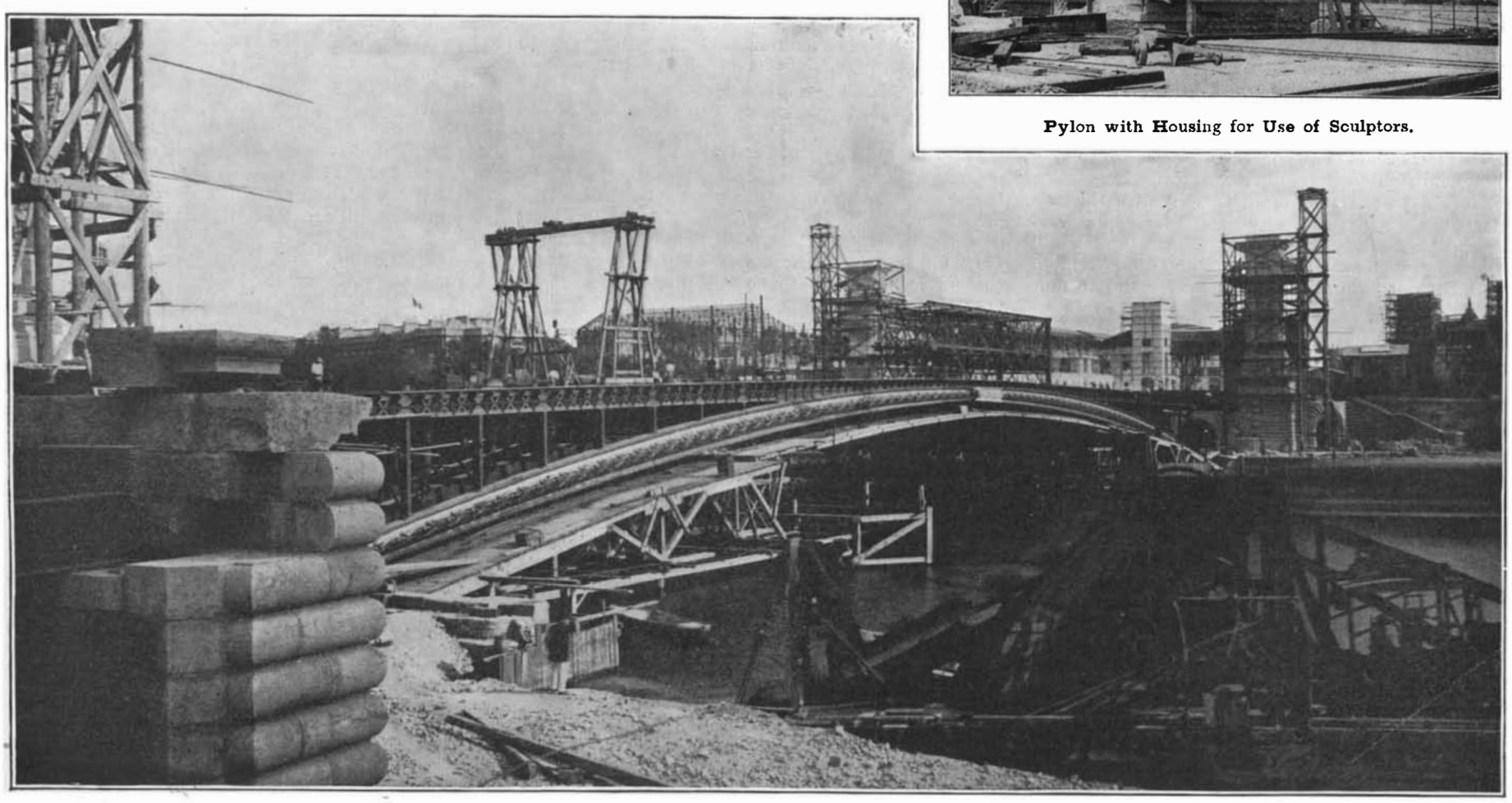
Interior Line of Arches—Masonry Approach.



Masonry Approach—Footing of Metallic Arch Shown at Left.

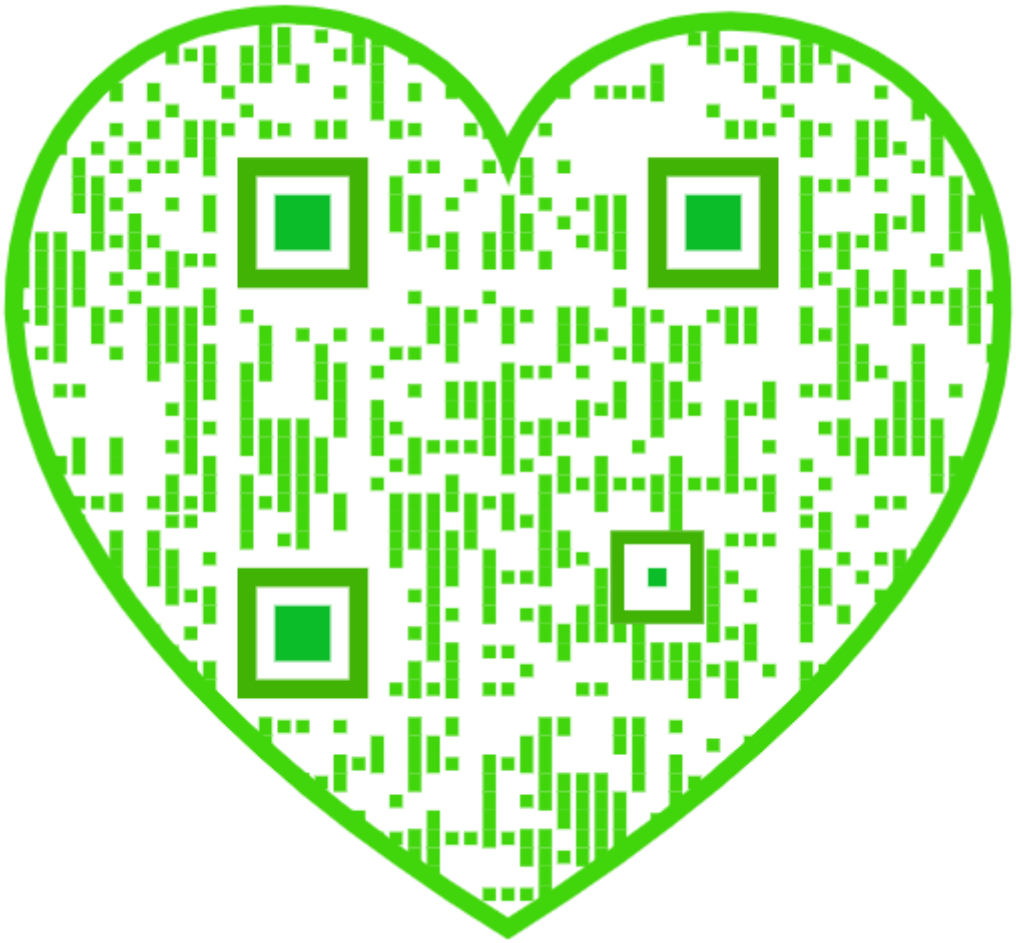


Pylon with Housing for Use of Sculptors.



View from Right Bank of Seine During Construction.

THE ALEXANDRE III. BRIDGE—THE NEW MONUMENTAL BRIDGE CONNECTING TWO SECTIONS OF THE PARIS EXPOSITION.—[See page 149.]



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NEW YORK, SATURDAY, MARCH 10, 1900.

CONSULAR REFORM.

There is now a bill pending in Congress which is of considerable importance. In effect it will give a life tenure to all persons now in the consular service. The bill provides that men now in the service must take an examination within two years to see if they are competent to remain in it. This is the seventh bill on the subject which has been presented to Congress in the last three years, and it provides for Consul-Generals of three classes. The salaries for Consul-Generals are from $5,000 to $8,000 per annum and for Consuls of six classes, the salaries range from $1,500 to $5,000 per annum. All existing consular offices are to be reclassified, and any of them which have become superfluous shall be abolished. The service is to be arranged by classes and not by places, so that consuls may be shifted from one station to another according to the needs of the service. All the unofficial fees which the consuls are now allowed to retain, are to be turned into the Treasury, and the only compensation which they receive will be their fixed salaries; this will probably make the service self-supporting. The entrance to the consular service is to be made after a competitive examination by a board composed of the Secretary of the State or an official of the State Department, an officer of the consular service and the civil service commissioners. The names of the five persons who pass the best examination are to be presented to the President and from them he can make his nomination and a new appointee may be dropped at any time during the first year of his service, but after that he can only be removed by a properly organized board. The bill also allows the assignment by the President's order of any consul to special duty in the United States for a period of not more than one year at a time and this permits of nomination to consulates without examination of persons who may have been in the classified service of the State Department for at least two years, thus making experience gained in the foreign service available for the home office and conversely experience in the home office available for the foreign service.

The subjects of examination for entrance are to be left largely to the examining board, but it includes a knowledge of French, German, or Spanish. A certain knowledge of law is also required. Our consular service is already excellent but could undoubtedly be improved by taking it practically out of politics. The excellent consular reports which are issued daily, a number of which are published each week in the SCIENTIFIC AMERICAN SUPPLEMENT, are an example of what our agents in all parts of the world are doing to disseminate information in regard to new discoveries and foreign trade. It is probable that with the new system these reports will be increased in number and importance. A great point of value in the new bill will be that it will insure stability to the service, and instead of a consul being in a district for two to four years, as the case may be, he would practically have an unlimited term of office in one locality unless a change was necessary for the good of the service. The House Committee on Foreign Affairs reported favorably on the Adams bill on March 1.

THE IVES' IMPROVED KROMSKOP.

At a meeting of the Camera Club in this city, February 27, Mr. F. E. Ives, of Philadelphia, lectured on the latest phases of "color photography," particularly as perfected in his new stereoscopic instrument named "The Kromskop." It was a most interesting and instructive demonstration of the utilization of the three simple primary colors, red, green, and blue-violet, in the transformation of black and white photographic images into images which had the appearance of the real thing delicately and exquisitely colored in its varied hues and tints. One of the chief features is the simple but accurate means of adjustment Mr. Ives has perfected for the absolute registration of the three separate colored images superimposed over the other. He has thus been enabled to produce an instrument usable by any skilled photographer.

A group of instruments were arranged about a table in which were a number of interesting subjects. But the lantern exhibition of merging the three different colored images into perfect registration, and the final production thereby of a beautifully-colored picture was the fulfillment of a scientific possibility that pleased everyone in the audience. We shall hope to give a further description of this instrument in a subsequent issue.

HAND AND MACHINE PRODUCTION COMPARED.

In the year 1894 Congress authorized the Department of Labor to investigate the questions of the effect of machinery upon the cost of production, and the relative power of production of hand and machine labor. The Commissioner of Labor, Mr. Carroll D. Wright, has organized and carried out his task with characteristic thoroughness, and the results which have been published afford a compendium of information on these questions which will be welcomed by all students of political economy.

It is to be understood that in the statistics presented the terms "hand" and "machine" production are not to be understood too literally. Hand operations necessarily enter to some extent into the most highly developed methods of machine manufacture of our day, and manufacture by hand, even in the simplest arts, involves the use of tools, and every tool is in some sense a machine. The actual comparison, then, is between modern methods using highly developed machinery and the methods in use in the days of hand-operated tools; when the strong arm and deft fingers of the individual mechanic took the place of the automobile power-driven machine.

It will be somewhat of a surprise to learn that in gathering the data for this comparison it was not necessary to go back further than the middle of the present century; for although it is true that the era of of factories began much earlier than this, in the year 1850 the old hand processes were still very largely in use. It was not until the latter half of the century was well begun that machine production began to assert its undeniable superiority over production by hand.

The report includes the statistics of eighty eight "main" industries, while nearly seven hundred branches of these have been investigated and the results tabulated. When we bear in mind that the number of separate operations in most of these is large—over one thousand, for instance, in the manufacture of watch movements—some idea may be gathered of the enormous labor of securing and tabulating the matter contained in the report. From the mass of data we select a few facts which show the extraordinary results obtained in certain industries.

A comparison of the producton of 10 ploughs in 1850 and 1896 shows that the number of different operations involved has risen from 11 to 97, while the number of workmen required has risen from 2 to 52. This shows that modern manufacture is more complicated, the artisans of earlier days performing work that is now subdivided among many operatives. But when the element of time is brought in, we find an enormous economy, the total numbers of hours required by the two workmen being 1,180, as against only 37½ hours required by the 52 machinists or machine tenders. Here we have a reduction in time of 31 to 1 in favor of automatic machinery. Not all of this, however, is gain, wages having risen from 60 cents to $1.25 and $2.60 a day; although even at this higher wage the economy is about 8 to 1, the cost of the labor necessary in making the ten ploughs having fallen from $54.46 in 1850 to $7.09 in 1896.

In the iron trade we find that the labor necessary to produce a file has been reduced one-third, while a rifle barrel which took 98 hours to make by hand in 1857, is now produced with a total 3⅔ hours of labor. In 1835, it took 84⅓ hours of hand labor to produce 100 feet of lap-welded pipe; in 1895, the same length was turned out with less than 5 hours of labor. Half a century ago 500 ½-inch bolts, 6 inches in length, complete with nuts, could be made complete in 43 hours; whereas modern machinery can turn out the same amount in 8 hours. One of the most remarkable comparisons is that between the manufacture of cut nails in 1813 and to-day; for our forefathers took 130 hours laboriously to produce an amount, which automatic machinery can now turn out in the space of one hour.

As one contemplates these remarkable figures, he may be pardoned if he fall into the error of supposing that modern machinery must mean the displacement of labor. As a matter of fact, it means the exact opposite; for in the first place the figures quoted take no note of the labor employed in making all this labor-displacing machinery, and, in the second place, the decreased cost of production, due to machinery, has lowered the selling price and increased the demand, and therefore the total volume of production, so enormously, as to make the final effect a large increase in the demand for labor.

Modern machinery, again, has so greatly enlarged the productive power of the workman that it becomes possible to pay him wages far in advance of those earned by his hand-labor predecessor, and the same labor-saving devices, while raising his wage, have increased its purchasing power by lowering the cost of food and clothing and many of the luxuries of life. Hence, the automatic machine is not, as the agitator will even yet suggest, the enemy of labor, but is in every respect its best friend.

PROTECTION OF INVENTIONS EXHIBITED AT PARIS.

The Paris Exhibition will be officially opened on April 15, 1900. Many inventors will take advantage of this opportunity to bring their productions to the notice of the large crowds of visitors that are expected to come to the French capital from all countries of the world. According to the French patent laws, public disclosure of an invention before the filing of an application for a patent, often deprives the inventor of his right to a valid French patent. The law of May 23, 1868, provides, however, that inventions exhibited at International Expositions may be protected, as if they were patented, from the time they are received at the Exposition, until three months after the closing of the exhibition. This temporary protection is secured by depositing a specification and drawings of the invention, together with a certificate stating that the object has been admitted as an exhibit, at the office of the governor (préfet) of the Departement de la Seine. These documents must be filed within a month after the opening of the Exposition, that is, before May 15, 1900. The exhibition of the model will be no bar to the securing of a French patent.

Persons who have already secured French patents, will secure material benefits by exhibiting at the Paris Fair. The French patent laws allow the privilege of importing patented goods into France only to citizens of certain countries, while Germans, Russians, and others would lose their French patent rights by such importation and would, therefore, be prevented from exhibiting their patented manufactures. The law of December 30, 1899, however, allows all foreigners to import any patented article into France for the purpose of exhibiting it at Paris, without endangering the validity of their French patents, provided these exhibits are again exported from France within three months after the close of the Exposition. Another provision of the law of December 30, 1899, which will be valuable to all foreigners, including our own citizens, makes the exhibition of a patented invention at the Paris Fair equivalent to manufacture in France, and as the French patent laws require that the manufacture should not be interrupted for more than two years, it will be sufficient for exhibitors to again manufacture their inventions in France within two years after the close of the Exposition. Furthermore, exhibits cannot be confiscated on account of alleged infringement of patents or trademarks, until three months after the close of the Exposition, but they may only be held temporarily, without withdrawing them from the Exposition. Even this temporary relief, however, will not be granted unless the complainant enjoys protection for his invention or trade mark in the alleged infringer's country. Should such infringing article be sold in France or remain there more than three months after the close of the Exposition, they will become liable to seizure.

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The annual report of Commissioner Duell will be welcomed as showing that the business of the Patent Office is rapidly recovering from the depressing effects of the late Spanish war, and although the figures are still far short of the high-water mark of the year 1897, the upward trend is so marked as to encourage the belief that the phenomenal business prosperity of the current year will carry the total number of applications to a point never reached before.

The total number of applications for 1899 was 41,443, as compared with 35,842 for 1898, the lowest for ten years, and 47,905 for 1897, which was about 4,000 more than were received in any previous year. These applications were divided as follows: 38,937 for patents, 2,400 for designs, 106 for reissues, 2,059 for registration of trade marks, 629 for registration of labels, and 143 for registration of prints. There were 25,435 patents granted, 92 patents reissued, 1,649 trade marks registered, with 511 labels and 100 prints. During the year 18,135 patents expired, 8,037 were awaiting the payment of final fees, while 3,997 were forfeited for the non-payment of fees.

The Patent Office again sustains its reputation as a self-supporting and surplus-earning institution. With a total receipts of $1,325,457 and a total expenditure of $1,211,783 there is the handsome surplus of $113,673. In the sixty-three years of its existence there have been only eight years in which the Patent Office has failed to show a surplus, the last case occurring during the war in 1861. Since that year the lowest surplus occurred in 1898, the distractions of war being the cause of the falling off to $1,538 from $252,798 in 1897. The largest surplus occurred in 1883 when it rose to nearly half a million dollars. The total balance to the credit of the Patent Office on the first of this year was $5,086,649.

An extremely interesting table in the report is that showing the number of patents issued in each State and the ratio of population to each patent granted. New York, as we should expect, heads the list with a total issue of 3,798 patents, followed by Pennsylvania with 2,355, Illinois with 2,152, Massachusetts with 1,774, and Ohio with 1,501. In the table showing the ratio of population to patents issued the citizens of Connecticut are found to hold a long lead, one patent being issued to every 945 inhabitants. Next in order are the following: District of Columbia, 1 to every 1,151; Massachusetts, 1 to every 1,262; Rhode Island, 1 to every 1,270; while New York comes eighth, with 1 to every 1,579. The fewest patents granted in proportion to the number of inhabitants were in the Southern States, South Carolina receiving 1 to every 25,024 inhabitants; North Carolina, 1 to every 21,012; and Alabama, one to every 17,195. It is thus that the New England States continue to stand pre-eminent for the inventive and mechanical bent of its people.

The statistics of patents granted to foreign inventors show that England maintains her lead, with Germany a good second. There were granted to residents of England 1,072 patents, and to those of Germany 888, while Canada received 371 and France 292. In making a comparison of the past four years we find evidence of a growing appreciation among foreign nations of the value of United States patents. The most remarkable figures are those for England and Germany, which have risen respectively from 617 to 1,072 and from 543 to 888. Canada, although possessing not over one-sixth the population of France, is a more frequent applicant at our patent office, 371 patents being granted in Canada as against 292 in France. Indeed in proportion to her population, Canada takes out by far the most American patents of all foreign countries.

UNITED STATES PATENTS GRANTED TO FOREIGNERS FROM 1896 TO 1899.

	1896	1897	1898	1899
England	617	706	964	1,072
Germany	543	551	634	888
Canada	244	286	345	371
France	194	222	258	292

That the examining work of the office has been kept well in hand is shown by the fact that while there were 5,467 applications awaiting action on December 27, 1898, 5,392 were awaiting action on December 26, 1899, and at both dates substantially all of the divisions were taking up amended cases for action, within 15 days after the amendments were filed.

A considerable portion of the report is taken up with a description of the "classification division," which has been actively at work through the year, and Commissioner Duell is able to report "considerable progress" although we note that the long-standing complaint of "lack of room" has still to be made. Limitations of space prevents any detailed review of the new system of classification, and we refer our readers to the current issue of the SUPPLEMENT where the report is printed in full. It is sufficient to say that the system adopted, being based upon the accumulated experience of over 60 years of work is comprehensive and adequate to the solution of a complicated and difficult problem, — how difficult and complicated may be judged from the facts that the present field of search consists of about 700,000 United States patents, 1,250,000 foreign patents and 74,000 volumes in the Patent Office library.

We regret to note that the Commissioner's expectation that in a few months some additional room would be placed at the disposal of the Patent Office has not yet been realized. Even when the Land Office vacates the Patent Office building, adequate accommodations will be wanting. Proper provision for the Patent Office and the construction of a fireproof building for its records are among the crying necessities of this institution.

The report concludes with the statement that the Commissioners appointed by Congress to revise the statutes relating to patents, trade and other marks has submitted a preliminary report and will shortly present a full report on this most important question. The Commissioner further states that a feature of this report which is of particular interest will be a proposed revision of the trade mark law to provide for the registration of trade marks used in interstate commerce, and to encourage a more generous registration of trade marks by reducing the registration fees.

The attention of Congress cannot be too strongly invited to the necessity of taking some measures to give manufacturers greater protection in regard to their property rights in trade marks. No more crying evil exists to-day than the anomolous condition of our trade-mark practice, and it is high time that the manufacturers of the country should demand legislation for protection of their rights, especially at a time when our foreign trade is advancing by leaps and bounds and American manufacturers are competing so successfully with foreign competitors in their home and colonial markets.

CALIFORNIA BIG TREES THREATENED WITH DESTRUCTION.

A project is seriously entertained by a company of lumbermen to cut down the grove of "Big Trees," which form one of the most striking natural features of Calaveras County in the State of California. These trees are perhaps one hundred in number and was discovered in 1852. Their fame has grown with the years, and thousands of visitors have gazed in amazement at these sublime instances of forest growth.

Compared with the greatest of trees in other parts of the world, they dwarf by their magnificent dimensions any others now known.

The Calaveras grove is situated near the Stanislaus River, about twenty miles distant from Murphy's Camp. Visitors to the Yosemite Valley often go out of their way to gaze upon these wonders, though, until recently, the trip involved a long and dusty journey.

A new railroad has invaded the locality and, consequently, has made the marketing of the timber a commercial possibility. A sawmill is being erected on the spot and operations are threatened with the advancing season. The prospect of a wholesale mutilation of the grove is imminent and the entire State is aroused at such a sacrilege. There are but a few groves of these trees in the Sierra Nevada's. None outside California. At Mariposa and on King's River there are scattering trunks but great as they are, there are none that compare in girth or altitude to those of Calaveros. The Sequoia gigantea is arrogant in its choice of locality, while the redwood, Sequoia temper rireus, flourish in profusion on the coast, in an atmosphere of fog and mist. The Sequoia gigantea lives only on the western slope of the Sierras, and derives its nourishment from the dry warm sunshine of the south. Beyond the latitude of San Francisco it will not flourish and either above or below an altitude of from 4,000 to 6,000 feet it grows only in dwarfish form. Efforts to transplant under other conditions, than these have all resulted in failure, only in England does partial success encourage the trial. In their native haunts the immense size of these trees is hardly comprehended. The Grizzly Giant is over 40 feet higher than the spire of Trinity church, New York. Its trunk at the base is 93 feet in circumference and 31 feet through. The height to the first limb is over 150 feet and these are from 3 to 6 feet in diameter where they spring from the trunk. The proportions are fine, and its age is estimated at 3,000 years.

There are in all only about one hundred of these trees, all confined in an area of 2,000 acres. It is believed that some of those which have succumbed to age and the elements attained an altitude of 450 feet. The wood is different in color from the redwood, being dark brown, but is equally useful. As a cabinet wood it has no superior. The amount of lumber contained in one of the larger of these trees is said to exceed 250,000 feet. Compared to the redwood the greatest of the Sequoia gigantea will grow to more than double the height the former ever attains. The people of California are unanimous in their determination, that the Calaveras grove shall not be destroyed. This will involve the purchase of the land, and provision for future care.

DISSOCIATION OF AIR AT ORDINARY PRESSURE.

Prof. Raoul Pictet, of Geneva, Switzerland, whose name is identified with the early liquefaction of air and gases, recently made a demonstration, says The N. Y. Sun, of a process of his invention for the separation of the oxygen and nitrogen of the air at ordinary pressure.

It is said that the process is one that is about to be introduced in this city on a commercial scale. Prof. Pictet's process as described consists in the initial production of a certain quantity of liquid air which is stored in tubes. Then through this is forced under a pressure of only about one atmosphere or fifteen pounds to the inch a stream of atmospheric air. This is cooled in the liquid air, but as it rises in a chamber beyond the gases of which it is composed separate themselves by gravity and run off in separate tubes. The oxygen being slightly the heavier, flows out through the lower tube, while the nitrogen goes off above. In addition to these gases, the air contains as an impurity carbonic acid gas, and this, it is asserted, leaves the machine in a liquid form being reduced to that form by the low temperature. In ordinary liquid air as it is produced by Tripler, Ostergren and others, the carbonic acid gas is frozen and gives the liquid air a milky appearance. It is taken out by pouring the liquid air through an ordinary paper filter.

In a demonstration recently, the apparatus used was of the laboratory character, and the proof of the effect was made by exposing a burning bunch of tow to the end of the pipe whence oxygen was expected to flow, where the combustion was made more intense, while at the end of the other pipe the neutral nitrogen diminished or extinguished the flame.

In the commercial machine, it is promised that with an expenditure of 500 horse-power the daily output will be 500,000 cubic feet of oxygen, ranging from 50 to 90 per cent in purity, and 1,000,000 cubic feet or more of nitrogen of similar quality. In addition it is promised that 1,500 pounds of liquid carbonic acid will be produced.

The two products for which a direct commercial use are expected to be found are the oxygen and the liquid carbonic acid gas. The latter already has a fixed place in the market and large quantities of it are saved in well-equipped breweries where it is produced in great bulk through the fermenting of the beer. It is pumped into steel tubes under a pressure that liquefies it. It is worth about seven and one-half cents a pound.

The great market which Prof. Pictet expects to find for the oxygen is to support combustion at high temperatures in furnaces where coal is burned, making such fires available for purposes which only the electric arc is now suitable for as well as making a great economy in producing heat for ordinary purposes. In burning fuel with the oxygen of the air there must be admitted to the furnace about three times the bulk of oxygen or nitrogen, and this absorbs a large quantity of the heat. If an excess of air goes into the furnace, this also takes up and wastes heat. By admitting oxygen these losses can be saved. This saving, Prof. Pictet thinks, would equal 40 per cent of the present fuel bill.

It is proposed to put the oxygen in tubes or tank cars and ship it to consumers. Of the theoretical value of it there can be no doubt. The commercial feature remains to be demonstrated. The nitrogen, it is asserted, can be used for the production of nitric acid and Prof. Pictet says that by a process of his invention he can combine it into ammonia directly by exposing hydrogen and nitrogen to the electric arc under certain conditions. If this be true, Prof. Pictet has solved a problem of wonderful value which has defied the researches of the ablest chemists of the world.

HORSEFLESH IN AMERICA.

Certain butchers in San Francisco have been detected in using horseflesh as a substitute for beef in sausages, Hamburg steaks, etc., owing to the cheapness of the equine flesh. The local Board of Health carefully investigated samples and has brought the offenders to justice. The flesh of horses selected with proper care and killed under proper conditions is by no means an unwholesome article of diet, says The New York Medical Journal, but there is no excuse for foisting it under false pretences upon customers in place of more expensive beef and other meats. If intended to be used as a food it should be sold openly, so that those who partake of it may know exactly what they are to consume and get the benefit of the difference in price.

In France, Germany, Austria, Belgium and other countries there are hippic butchers who make a specialty of this food, and, as is well known in Paris, the sale of horseflesh is very considerable. The butchers, however, are licensed, and the animals are slaughtered with as much attention to sanitation as are beeves. Fortunately, it is very easy to detect the presence of horse meat even in as small percentages as five per cent. Twenty grammes of sausage finely minced are boiled from a half hour to an hour in 100 cubic centimeters of water. The volume of water is then reduced by evaporation to thirty cubic centimeters, then the liquid is cooled and filtered. About ten cubic centimeters are tested with a few drops of compound iodine solution (one part of iodine and twelve parts of potassium iodie in 100 parts of water). A fugitive reddish violet coloration indicates the presence of horse meat. The re-agent must be added carefully, so that no excess is added, as this is apt to change the color to a reddish-brown. It is probable, as our medical contemporary hints, that a little investigation in various cities will bring to light the mysterious hidden ways of the sausage vender.

THE BEET SUGAR INDUSTRY.

Two-thirds of the world's sugar is now produced from beets. Prior to 1871–72 the world's production of beet sugar had reached a million tons; in the present crop year it is, according to latest estimates 5,510,000 tons, while the cane sugar crop which in 1871–72 was 1,599,000 tons is in the present year 2,904,000 tons. Thus cane sugar production has scarcely doubled during the period under consideration, while that from beets has more than quintupled. Meantime the price has fallen more than one-half, the average cost in foreign countries of all sugar imported into the United States in the fiscal year of 1872 being 5·37 cents per pound, and in 1899 2·39 cents per pound. These facts are interesting in view of the consideration of matters by Congress relating to the sugar-producing islands which have recently come into closer relations with the United States.

The sugar-producing area of the world has in less than half a century been shifted from the tropics northward and the farmer of the temperate zone has shown his ability not only to compete with the low-priced labor of the tropics, but in doing so to reduce by one-half the cost of the article produced.

THE FIRST AUTOMOBILE PATROL WAGON.

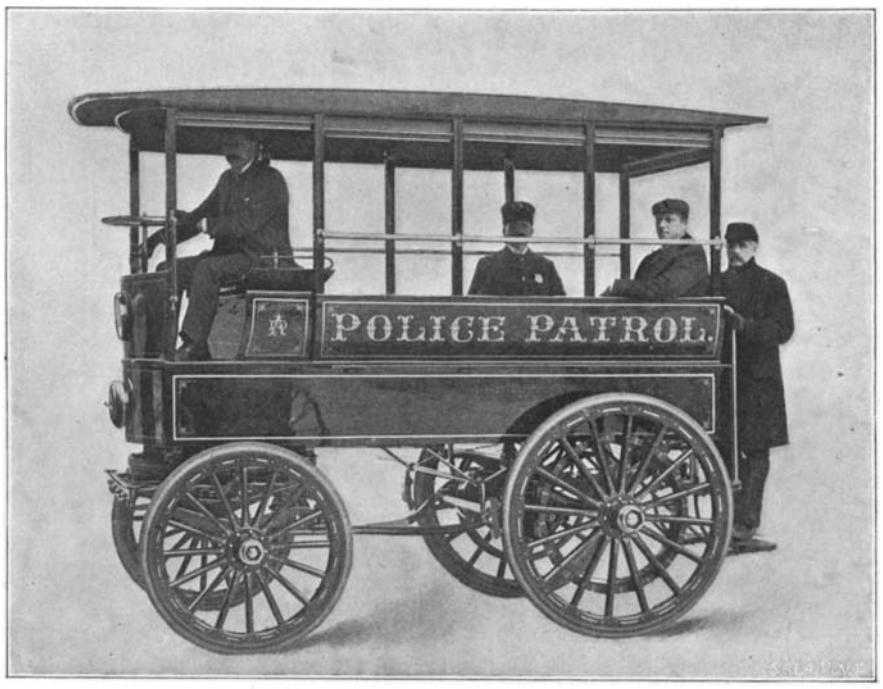
The town of Akron, Ohio, lays claim to the distinction of having constructed the first automobile patrol wagon ever used. The wagon in question was not made by a horseless carriage manufacturer, but was designed and built by a local mechanical engineer, Mr. Frank P. Loomis.

The vehicle is driven by two four-horse power electric motors, geared in the usual manner with the rear wheels. Current is supplied by an accumulator of 40 cells, stowed beneath the seats of the vehicle in four sets of ten cells each, and grouped as the driver may desire by means of a controller within reach of his left hand. A meter at his right hand indicates the amount of current at his disposal.

The steering mechanism consists of a hand-wheel, the vertical shaft of which is connected by a segmental gear with a fifth-wheel provided with roller bearings.

The braking devices comprise two sets of friction rollers forced into engagement with the tires of the rear wheels by means of a foot-lever, and a band-brake connected with the gearing of the rear wheels and controlled by a hand-lever beneath the steering-wheel in front of the driver.

The wagon body is 10 feet long, 4 feet 4 inches wide, and is supported on rubber-tired wooden wheels carried by roller-bearing axles. The vehicle has a maximum speed of twenty miles an hour, weighs 5,500 pounds, and cost the city of Akron about $3,000. For our descriptive matter and illustration we are indebted to Mr. E. J. Hoskin, of Akron, Ohio.



THE FIRST AUTOMOBILE PATROL WAGON.

A New Variable Star in Algol.

Another remarkable variable star of the Algol class has been discovered by Mme. Ceraski. From an examination of the Draper Memorial photographs of this star, it appears that while the star has its full brightness on 45 of them, on several of the early photographs it is so faint that they must have been taken when the star was near minimum. The Moscow photographs furnish the means of determining the periods from an interval of four years, the Harvard photographs increase this interval to nine years. Five stars of the Algol class, S Cancri, U Cephei, W Delphini, +45°3062, and the star referred to are specially interesting, says Prof. Edward C. Pickering, owing to the large variation in their light, which amounts to about two magnitudes in each case. It is remarkable that two of these were found by Mme. Ceraski, and one by her distinguished husband.

AN ELECTRIC AUTOMOBILE AMBULANCE.

The ambulance service in our American cities is the model one of the world, so that it is little wonder that we are to have what is probably the first electric ambulance, certainly the one we illustrate is the first ever built in the United States. There are many reasons why an automobile ambulance has marked advantages over the horse vehicles. It is capable of greater sustained speed, and when the destination is reached no care has to be paid to the steaming horse, and both surgeon and driver can devote their attention to the injured person. Accidents to ambulances are of frequent occurrence, owing to their speed and their right of way, but electric vehicles can be stopped in their length, Every second is of importance to an injured person, and speed and ease of riding will undoubtedly soon make them a great favorite among hospital authorities. Another feature of interest is the lower cost of maintenance. An ambulance is usually idle twenty or more hours out of the twenty-four, and this gives ample time for charging the batteries. There is no time lost in hitching up, and the stable may be in the hospital proper, without the dangers of stable odors.

The electric ambulance shown in our engraving was built by F. R. Wood & Son, of New York city, for St. Vincent's Hospital. It is handsome in appearance, being well finished. The openings are all inclosed with beveled plate glass windows which open or close with ease. The vehicle is steered from the front wheels and is propelled by two 2-horse power motors, which are suspended on the rear axle. The current for the motors is supplied by 44 cells of storage batteries and it is managed by a controller placed under the seat entirely out of view. This controller permits of three speeds ahead, 6, 9 and 13 miles per hour, and two speeds to the rear, 3 and 6 miles per hour. The radius of action of the ambulance is 25 to 30 miles.

The Wood pedestal gear is used, making it possible to have the body low, which is essential in an ambulance, and adds to its appearance. All the fore and aft bending strain on the springs is relieved by the pedestals sliding vertically up and down on the pedestal box. The driver is in immediate communication with the surgeon by the aid of a speaking-tube. The inside trimming is of leather, and the bed slides out, and being caught by irons, stands out parallel with the sidewalk, thus enabling a patient to be placed upon the bed without the necessity of being jolted, which is inseparable to the use of stationary beds. The inside and outside electric lights are of ten-candle power each. The mountings are all of brass.

NEW ELECTRIC AMBULANCE FOR ST. VINCENT'S HOSPITAL, N. Y. CITY.

Experiments With Decimal Instruments in the French Marine.

The experiments which were commenced last June on several vessels of the French navy at the Naval School at Brest, and in several hydrographic schools, for the purpose of studying the advantages of the employment in navigation of the decimal measures of angles, will, according to the original programme, close at the termination of February, 1900.

The correspondent of The Moniteur de la Bijouterie et de l'Horlogerie says:

We are happy to recall the fact that the instruments, maps, sextants, compass roses, decimal chronometers, etc., which are employed, appeared at the exposition of the apparatus for the measure of time and angles, graduated according to the decimal system.

This exposition was organized on the occasion of the congress of the scientific societies at Toulouse by the Geographical Society of this city, at the instance of M. De Rey-Pailhade, ex-president, and the promoter of this important reform, of which the success is now certain. The numerous instruments exhibited forcibly drew the attention of all interested, and particularly of General Sesmaisons, commander of the 17th Army Corps. The experiments are under the direction of Captain Guyon, a prominent member of the Bureau of Longitudes, who was appointed by the Ministerial Commission on Decimalization.

Each experimenter will present a detailed report to the Bureau of Longitudes on the employment of the new decimal units of angles. That learned body will publish a resumé of the experiments for submission to the decision of the International Congress, specially charged with the consideration of this subject.

The scientific societies of our city which, during the revolution, was one of the first to adopt the decimal division of time, will follow with interest the results of this truly scientific event, this effort for the extension of the work of the immortal creators of the decimal metric system.

The following incident shows the value that was attached to the decimal time:

Antoine Alric, a watchmaker of Toulouse, was arrested and imprisoned on December 7, 1793, for having "uttered his aristocratic opinions on all occasions." Alric had devoted time to the decimal hour, which had been encouraged by a decree of the National Convention on the 21st Pluviose of the year 2, establishing a public competition of decimal watches. The Toulouse Committee of Safety, of whom the watchmaker had demanded his liberty, reported to the national agent: "We do not think that Alric, watchmaker, deserves to be set free; but we will engage him to execute his plan as to the decimal watches." Alric was discharged on the 10th Fructidor, year 2, as more talkative than dangerous.

At the congress of the societies there was a beautiful clock, which, through the ingenuity of M. Raffy, presented simultaneously the ordinary hours and the decimal time by means of divisions and hands in two colors; every body understood the decimal time at the first view. This remarkable timepiece realized the wish expressed by the municipal authorities of Toulouse, at the sitting of the 15th Fructidor of the year 6, that, "The clock of the capitol should indicate both the decimal and the duodecimal hours, in order that the public should understand their relations to each other."

It is interesting to remember that the new experiments take place at exactly a century after the establishment of the metric system. It was on April 23, 1799, that the commission of the national convention, charged with the preparation of the meter, completed its work. On June 22, 1799, the meter and the kilogramme in platina were presented to the united legislative body. On December 10, 1799, the second law constituting the decimal metrical system was enacted, fixing definitely the values of the meter and the kilogramme.

Our Coal Production.

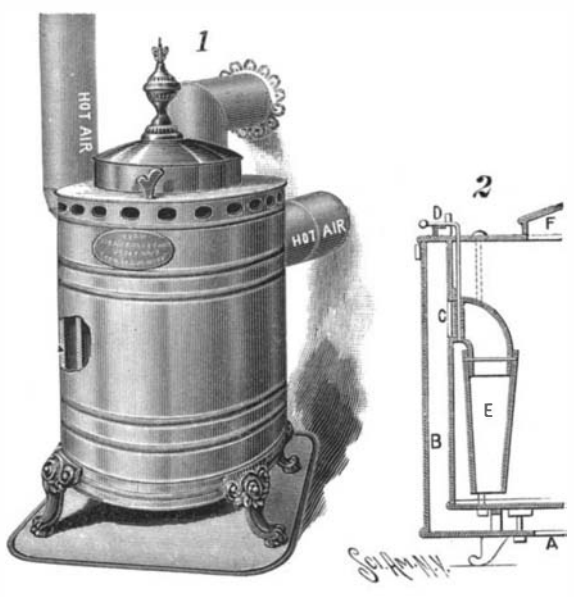
The fact that the United States has become the world's greatest producer of coal, and at a cost for production far below that of any other part of the world, is attracting great attention, especially from British producers and consumers of coal. The present output of the United States is larger than that of the United Kingdom, and coal can be bought in America at the pit mouth at $1.18 a ton as against $1.36 paid in Great Britain. The result is that people in Lancashire are talking about bringing coal from America to Lancashire. In 1870, the United States produced 86,806,560 short-tons, and in the same year the United Kingdom produced 123,682,935 short-tons. In 1880, our production of coal had risen to 71,481,569 short-tons, while that of the United Kingdom was 164,605,738 short-tons, and in 1899 the total amount of coal produced in the United States was 244,000,000 short-tons against 234,000,000 short-tons of the United Kingdom.

THE last remaining relic of the first railway in London has just disappeared. In 1801, an act was passed authorizing the construction of a rail way from Wandsworth to Croydon, the sleepers being of stone and motor power was provided by horses. The scheme included a dock at Wandsworth and it is the ancient wooden crane connected therewith which has just fallen into the waters of the Wandle.

A COMBINED HEATING STOVE AND FURNACE.

The stove which we illustrate herewith is an improvement over ordinary stoves in so far as it serves the purpose of a furnace for distant rooms. In the construction of this furnace-stove only sheet metal is used, whereby the cost of manufacture is considerably reduced and the durability enhanced.

The stove consists of an oval outer casing, formed with a draft opening, *A*, in its bottom. Within this outer casing is a concentric, oval firepot separated from the outer casing so as to leave an air space, *B*, around the firepot. Legs pass through the casing, the inserted end portions of the legs engaging with sockets formed on the bottom of the firepot, to take load strain from the casing. Fuel is introduced through an aperture in a top plate having a cover, *F*, in the rear of which is a circular flange which receives a draft-pipe. The heat of the firepot is distributed to other rooms by hot-air pipes fitting on thimbles on the outer casing. Each of



A COMBINED HEATING STOVE AND FURNACE.

the thimbles is provided with a damper whereby the supply of hot air can be cut off. At the front end of the oval firepot an aperture is formed which receives a draft elbow, provided with a cast iron extension *E*, which can be removed when burnt out. The throat of the elbow is closed by a damper, *C*, controlled by a rod extending upwardly through the top plate.

Fire being made in the firepot, cold air is drawn through the opening, *A*, in the outer casing and is conducted by the draft elbow into the burning fuel. As the firepot is heated the air in the space, *B*, is also heated. This hot air arises and passes through the hot-air pipes into the rooms to be warmed. To permit the escape of the heated air directly into the room in which the stove is placed, the upper portion of the outer casing is provided with a series of openings, which can be closed by a rotatable metal band having similar openings designed to register with those of the casing. By moving the band the casing-openings can be partially or entirely opened and closed.

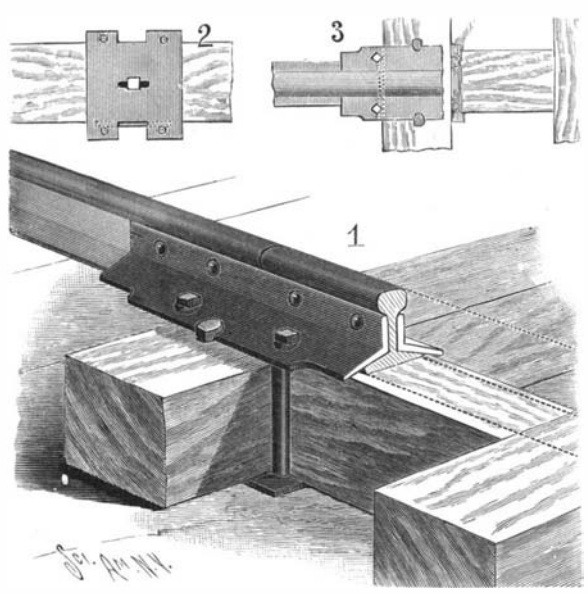
The inventors of this furnace, Wormald & Wormald, of Spokane, Wash., state that the stove has proven its efficiency on many an occasion. The saving in fuel effected by its use is said to be very marked; for one furnace stove is made to take the place of several ordinary stoves distributed in various rooms.

Mural Paintings Emblematic of Electricity.

Mr. W. B. Van Ingen, mural painter of New York, has opened an entirely new field by his large panels which decorate the offices of the Edison Illuminating Company in Duane Street, New York city. Instead of making his figures purely allegorical as does Puvis da Chavannes in the Boston Library, Mr. Van Ingen has taken some very workaday scenes like "Edison in his Laboratory," "Faraday and the Electric Motor," "Sir Humphrey Davy and his Electric Arc Light," and while utilizing them, has still clothed them in enough of the nineteenth century to make them interesting, for they tell the story admirably. There are many large concerns whose offices might be decorated in a similar manner emblematic of their manufactures. The idea is an attractive one and we would like to see it carried out on other industries in the same manner as has been done for electricity.

AN ANCHOR TO PREVENT THE CREEPING OF RAILS.

To prevent the creeping tendency of rails, and yet to allow the track to expand and contract is the object of an invention patented by Severin B. Anderson, of Hartford, Wash. This object is attained by means of the novel anchor represented in the accompanying illustrations. Fig. 1 is a perspective view of a rail with the anchor applied. Fig. 2 is an inverted plan view showing the anchor-plate. And Fig. 3 is a top plan view of a rail with the invention applied. The adjacent ends of rails are joined by angle-iron fish-plates spiked to the tie and bolted to the rails. The ends of the fish-plates project beyond the base of the rails; and through these projecting portions bolts are passed which rigidly connect the fish-plates with an anchor-plate on the under side of the tie. The plate, as shown in Fig 2, is provided with a longitudinal slot; and a bolt extends through the tie and slot to hold the anchor-plate to the tie and permit adjustment of the plate lengthwise of the tie. Between the tie at the joint of the rails and the next following tie, located in the direction of the creeping tendency, is a brace-block formed with a brace-plate which partially embraces the bolts connecting the fish and anchor plates and prevents the wearing of the bolts on the brace-block. On the opposite side of the tie a face plate is provided, upon which the bolts connecting the fish and anchor plates rest. The face-plate serves to prevent the embedding of the bolts in the tie. It will be seen that, although the fish-plates are so firmly locked in place, the rail can, nevertheless, expand and contract. The creeping of the rails is prevented by the means employed for securing the fish-plates. Dislocation of the tie by the creeping of the rails is prevented by the brace-block. The anchor-plate, being transversely adjustable, can be brought in position to insure the proper alinement of the rails. The track can be readily raised and surfaced without any interference from the device.



AN ANCHOR TO PREVENT THE CREEPING OF RAILS.

THE ALEXANDRE III. BRIDGE, PARIS.

BY J. GUENAIRE.

One of the most interesting features of the approaching Paris Exposition will be the handsome bridge which unites the different portions near the Champs d'Elysées, and forms part of the principal avenue, to be called the Esplanade des Invalides. This avenue commences at the Champs d'Elysées, having on either side the great and smaller palaces, and passes over the new bridge. On the left bank of the Seine it will be bordered by a succession of buildings of the Exposition, and will terminate at the imposing structure called the Hotel des Invalides, containing the tomb of Napoleon.

It was decided to give to the bridge the name of Alexander III., in honor of the father of the present Czar Nicolas II., whose visit to Paris, in 1896, consummated the alliance between France and Russia, begun by the late emperor, and it was in the midst of a series of splended fêtes that the Czar assisted at the laying of the corner-stone.

The construction of the bridge presents many points of interest. As will be seen in our illustrations, it consists of a series of metallic arches, whose thrust is received by the abutments on either bank. Accordingly the dimensions and construction of these abutments have been such as to assure great solidity. Each of the abutments forms a mass 44 meters (144·36 feet) wide and 30 meters (98·43 feet) in thickness, being formed of masonry and cement, with an outside covering of blue granite. The whole constitutes a block which offers as much resistance as if it were composed of a single stone.

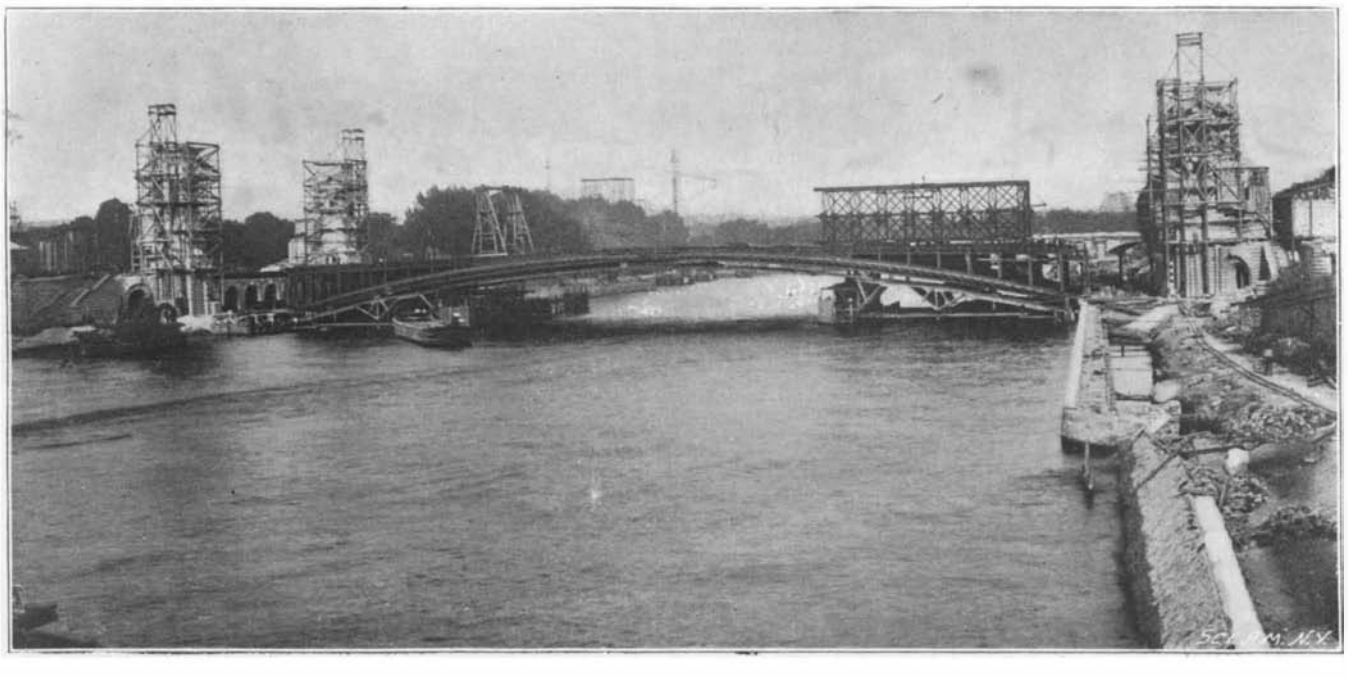
The foundations are separated from the clay stratum here existing in the bed of the river by a certain thickness of sand. As the horizontal thrust of the arches upon the abutments is considerable, the stability of these latter is secured by the effect of the friction of the abutment upon its bed, this being, in fact, greater than the maximum thrust of the arches. Experiments have been made with samples of sand extracted from the strata, and it is found that the coefficient of friction is more than 0·58, and on the other hand the relation between the horizontal thrust and the weight of the abutments is only 0·50. In this way the thrust of the arches will always be more than counterbalanced, and the perfect stability of the abutments assured.

In the construction of the abutments, metallic caissons were necessary; these were of more than ordinary dimensions, and were built upon the spot where they were to be sunk in the stream. The joints were carefully caulked with bitumen and felt, and thus perfect tightness was assured. These caissons, 44 by 36 meters in size, were divided into five compartments, each of these being provided with two shafts or chimneys for the descent of workmen and materials of construction. The material excavated from the bed of the river was taken out by the same shafts and emptied into the stream, from which it was removed by dredging machines. Some difficulty was encountered in the construction of the abutments by these caissons, as it was necessary that all parts of the caisson should sink the same distance as the work progressed. However, by establishing a series of water levels, connected by rubber tubing, a uniform rate of sinking was attained.

After the caissons had been sunk to the required depth in the bed of the river, they were filled with bêton, consisting of a mixture of cement and gravel; this was filled in commencing from the walls and working toward the shafts.

The work of construction of the abutments was commenced on April 19, 1897, and the operation of filling the caissons was finished March 26, 1898. The mean rate of descent of the caissons was about 12 centimeters (4·72 inches) per day. Two important questions were those of furnishing air and light to the workmen. For the lighting, incandescent lamps were used, to avoid vitiating the air in the enclosed space. Two groups of engines and dynamos were installed for the purpose, one of these acting as a reserve in case of accident; each group included a Radsworth engine driving a continuous-current dynamo at 140 volts. Three lines of wiring were used for the interior and exterior lighting, each caisson requiring about 130 lamps.

The essential portion of the abutments having been constructed, the work of mounting the metallic part of the bridge was next in order. In view of the existing conditions of traffic upon the Seine, the arch could not be con



THE ALEXANDRE III. BRIDGE FROM THE RIVER, SHOWING PYLONS.

structed in the ordinary manner, which consists in sinking piles into the river bed, upon which a long scaffolding is built reaching from one bank to the other, leaving only a narrow opening in the center for the passage of boats. According to the terms of agreement, the constructors were required to leave a passage of at least fifty meters (164 feet) in width in the center of the river, as on account of the curvature of the Seine at this point, the trains of merchant boats, which sometimes have a length of 150 meters (500 feet) could not pass without difficulty in a narrower space, and the agreement stipulated that there should be no interruption of navigation during the work of erecting the bridge.

For this reason, the construction of the arches was carried out entirely from above, by means of a temporary bridge called the "Passarelle," extending from one bank to the other. It was supported on rollers at each end, as shown at the right-hand end of our larger view, and could thus be moved from side to side as the work required; upon it were established the steam engines, hoists, and cranes for the transport and putting in place of materials. Its length was about 130 meters (420·5 feet); its width, (6 meters 19·68 feet); and height, 7½ meters (24·6 feet), and it was the largest construction of this kind yet made. It was built on the right bank of the river on a high scaffolding, the other end being upheld by a floating scaffolding in the river; when one-third of the passarelle was finished, it was drawn forward by means of ropes attached to drums, thus permitting the second part to be constructed in the rear. This was drawn forward in turn, and thus the whole construction was extended across the river between the abutments.

The supports on which it rolled back and forth over the arches were formed at the base by a strong iron frame upon which a pyramidal construction was built to sustain the inward end of the passarelle. These pyramids were about 6 meters (19·68 feet) in height; the base rested upon ten rollers arranged in two series of five each, rolling on rails 4 meters (13·12 feet) apart. To give additional stability to the passarelle, a series of piles was driven in the stream near the bank, upholding an iron structure which supported the passarelle at that point.

The bridge proper is composed of fifteen great metallic arches placed side by side and connected one to the other by intermediate pieces, as will be seen in the end-view of these arches. Upon the arches are secured vertical steel frames supporting the horizontal I beams above. Upon these will be laid the iron planking and wood pavement of the bridge. The arches are built up of sixty-four short sections or voussoirs, which are bolted together end to end. These sections are massive steel pieces having a length of 3 meters (9·84 feet) and weighing 7,000 kilogrammes each (15,432 pounds). Their section resembles that of a T, having 6 centimeters (2.36 inches) thickness in the web.

Two arches at a time are constructed for a given position of the passarelle; traveling cranes take up the voussoirs from the end of the passarelle and bring them into the proper places on the arch. The method of construction of this bridge somewhat resembles that used in the case of stone bridges. The piece constituting the origin of the arch is solidly fixed into grooves made in the granite blocks of the abutment, and upon this piece is fixed the first voussoir, it being held by a cylindrical key of special construction, thus forming a movable joint at the beginning of the arch. The piece corresponding to the keystone of the arch carries a similar articulation, the rest of the voussoirs being solidly bolted together. Before bolting, however, their position must be regulated with care. To this end the voussoir is first brought into its approximate position by the movable carriage on the passarelle above, it being upheld by timber supports. For the final regulation, thin metal plates are inserted between the two voussoirs, until the required form is obtained as determined by the template of the arch, after which the voussoir is solidly bolted in place. The regulation of the arch as a whole then remains to be made. This is accomplished by means of the joint arranged for the purpose in the keystone. Here thin metal plates are added or taken out until the desired form is obtained. This is determined by surveying instruments placed at different positions on either bank.

The first two arches being thus finished, the passarelle was moved into position over the second pair. This was done by means of capstans acting upon its rollers. In this manner eight different positions were successively taken in order to complete the fifteen parallel arches of the bridge. Since the photograph was taken the passarelle has been taken down as it has served its purpose in the construction and the assembling of the metallic parts of the bridge proper is practically finished. The finished bridge presents a curve having 7 meters (22·96 feet) distance from height to base. Its total length is 110 meters (360·91 feet) between the abutments and its width 40 meters (131·24 feet). It is to have two sidewalks of 10 meters (32·81 feet) wide, leaving a central space of 20 meters (65·62 feet) for vehicles.

The approaches to the bridge are upheld by a series of stone arches, of which the outside series is shown in one of the upper illustrations on front page, and is built of blue granite; behind this are a second and third series of arches; these arches, being concealed from view, are of inferior materials. Upon these arches will be laid the I beams and flooring constituting the approaches. In another illustration on the extreme left will be seen the iron footing of the bridge resting against the stone abutment.

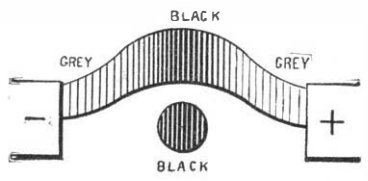
As the bridge has been constructed in view of the Exposition, its decorative effect has been made prominent, and it will harmonize with the buildings now being erected on either side of it. There will be two large and handsome pylons at either end, one of these being shown surrounded with scaffolding and the sculptors' temporary house. These pylons resemble in their material and architectural motifs the construction used in the great and smaller palaces. Each of the pylons will have an allegorical figure and will be surmounted by a bronze group, designed by Fremiet and other sculptors. At either side of the pylons is a large carved figure of a lion led by a child. The bridge is to have a handsome stone balustrade upon which will be mounted a series of decorative bronze lamp posts.

RADIO-ACTIVE MATTER IN MAGNETIC FIELD.

M. Becquerel has given an account to the Academie des Sciences of a remarkable phenomenon which he has observed in the course of his experiments upon radio-active matter. He finds that a magnetic field has a marked effect upon the action of these bodies, and when placed between the poles of a powerful electro-magnet, the radiation which they emit is changed in direction and becomes concentrated upon the poles. In the first experiment, the effect was observed with the radiation parallel to the magnetic lines of force. Between the pole pieces of the electro-magnet were placed two circular soft iron disks, fourteen millimeters in diameter, so arranged that their distance could be varied from a few millimeters to several centimeters. Upon exciting the magnet, a powerful field is established between the disks. Near the center of one of the disks was disposed the radio-active matter, containing the supposed new element, radium, whose action is very powerful; this was placed upon paper and covered with a thin leaf of aluminium. Against the other pole was placed a fluorescent screen, such as platinocyanide of barium, double sulphate of uranium and potassium, etc. When the electro-magnet was unexcited, the phosphorescence excited in the screen by the radio-active matter appeared as a large luminous spot extending beyond the polar surface containing the screen; at a distance of one centimeter between the disks, the screen is but feebly phosphorescent. Upon exciting the electro-magnet, the luminous spot is seen to contract and become more intense; the illuminated area scarcely reaches beyond the limits of the pole-piece, upon which all the rays of the active matter seem to be concentrated, with a resulting increase of brilliancy. Upon reversing the magnetization, no appreciable difference is observed. The interposition of screens, such as black paper, glass, etc., cause only a diminution of intensity. If a photographic plate is substituted for the phosphorescent screen, one may obtain, with exposures of a few instants, an interesting series of negatives. Among others, M. Becquerel shows a plate which he obtained at a distance of fifteen millimeters; upon this may be seen first the feeble impression when the magnet is not excited, then the more strongly marked and concentrated effect caused by the magnetic field.

To observe the effect when the direction of the screen is parallel to the magnetic flux, the radio-active matter, covered as before with aluminium, was placed in the center of a glass tube arranged in the axis of the field; the interior walls of this tube being covered with fluorescent matter, forming a cylindrical screen. Upon exciting the magnet, the phosphorescence is seen to diminish considerably, even to a point where it is scarcely perceptible. In another experiment, the active matter is placed between the pole-pieces, somewhat below the center, and a flat screen is placed at an equal distance above and parallel to the lines of force.

Fig. 1.



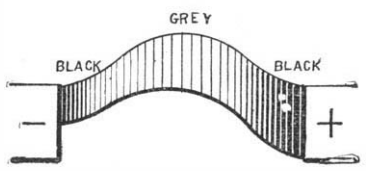


Fig. 2.

Under these conditions, the effect changes with the direction of magnetization; in one case the luminous spot becomes more brilliant, in the other it diminishes. This may be very well observed by using a photographic plate. In one experiment, the plate, wrapped with black paper, is placed between the poles and parallel to the field, the distance between the poles being forty-five millimeters; the magnet is first excited, and upon the plate, midway between the poles, is placed a small quantity of radio-active matter. After a few minutes' exposure under these conditions, the plate was developed, and it was found that the impression, which was very intense, was not uniformly distributed around the source, but was entirely thrown over to one side of the field, this being to the positive pole of the magnet. Outside of the black spot marking the position of the active matter, the maximum impression is distributed over a relatively limited region, giving somewhat the effect shown in Fig. 1, which shows the direction of the curve and the relative values, but not the actual appearance of the plate. The maximum of luminous effect as well as of curvature is in the center of the field; on either side the curve bends in and joins the polar surfaces somewhat above their centers. The experiment was then tried with the active matter placed near one of the poles, with the plate in the same position. The effect differs from the former, as shown in Fig. 2. The action is strong in the vicinity of the active matter near the + pole, and from this the intensity diminishes, reaching a minimum in the center of the field, from which it augments in approaching the other pole. Near the pole it becomes again very intense, but less so than on the other side. By varying the position of the active matter between the poles, a series of curves may be obtained whose maxima are opposite the point occupied by the source, the maximum has, however, a tendency to approach the neighboring pole. When the active matter is but a short distance from the pole, a second maximum appears near the opposite pole, the effect being analogous to that of Fig. 2.

Commerce of the Great Lakes.

A suggestion of the extent of the commerce of the great inland sea extending from Buffalo to Chicago and Duluth, known as the "Great Lakes" is supplied by some figures which have been issued by the Treasury Bureau of Statistics, showing the details of the commerce passing through the Sault Ste. Marie Canal, which connects Lake Superior with Lakes Michigan, Huron, Erie and Ontario. This necessarily registers only the traffic between the single lake, Superior, with Duluth, as its great concentrating and distributing point, and the chain, Michigan, Huron, Erie and Ontario with Chicago, Detroit, Toledo, Cleveland and Buffalo, the great points of concentration and distribution. The commerce passing through the canal thus registers accurately the movement between the single lake penetrating the wheat and iron producing regions and the chain tributary to the corn, provision and coal producing and iron manufacturing regions. It is the great gateway through which wheat, oats, flour, iron ore, copper and lumber of Montana, the Dakotas, Minnesota and Northern Wisconsin move to the consuming and manufacturing sections, while through the same gateway moves in the reverse direction the coal manufactures and miscellaneous merchandise from Lake Erie and Eastern points.

All of the traffic moving between Lake Superior and the chain of Lakes from Chicago to Buffalo must pass through either the American or Canadian Canal which lie side by side. Of the total business through the two canals in 1899, 88 per cent was carried by the American Canal, while of the passenger business 68 per cent passed through the same canal. It is only by a comparison of figures of 1899 with those of earlier years that the importance of this commerce can be realized, especially as regards its rapid growth. The actual number of passages through the canal, counting each vessel as it passed through it, was 20,055, during 1899, against 9,579 in 1889, having thus more than doubled during a period of ten years. The total freight business passing through the canal in 1899 was 25,255,810 tons against 7,516,022 tons in 1889, showing that the freight tonnage has increased much more rapidly than the number of vessels, thus indicating in some degree the rapid increase in the size and capacity of freight-carrying vessels of the Great Lakes. The development of grain production of the extreme Northwest during the decade is indicated by the fact that the wheat carried through the canal in 1899 was 58,297,335 bushels, while in 1889 16,231,854 bushels were carried, while grain other than wheat in 1899 amounted to 30,900,935 bushels, while in 1889 it was but 2,133,245 bushels.

THE current through the iron gate of the Danube is still far too rapid owing to the sharp incline and the work of excavation does not suffice to secure the expected depth. The navigable channel created by blasting under water is not quite regular. Ridges have been discovered and through additional lines of buoys have been fixed, further work will be required.

Science Notes.

An appendicitis club has been formed in Cleveland, Ohio. To become a member of this unique organization, one must have been operated upon for appendicitis.

Our excellent contemporary, "Science Abstracts," has just been enlarged and several new features have been added. There is included in it an entirely new section on steam plant, gas and oil engines and also abstracts dealing with motor cars of all kinds.

The Royal Geographical Society has awarded the "Wollaston Medal" to Grove K. Gilbert, geologist of the United States Geological Survey. The medal was received in behalf of Mr. Gilbert by Henry White, Esq., Secretary of the United States Embassy. This makes the third time that the honor has gone to an American.

M. Raphael Bischoffsheim, has made over the freehold of the Nice Observatory which he founded, together with $500,000 to be devoted to the maintenance of the establishment. The total value of the gift is considered to be worth a million dollars and the continuance of the work is assured by this munificent gift.

The archæological explorations in Algeria are lagging, owing to lack of funds. Only about $10,000 a year is available for the work at Timgad. The government has assigned $100,000 to pay for researches in Delphi, and all the objects found become the property of the Greek government, so it is little wonder that Frenchmen are dissatisfied at the favor shown to Greece. There are still over one hundred acres to be excavated at Timgad, and the work can be carried on only very slowly.

The Christmas-tree business has assumed large proportions, and the result is that considerable injury is done to forests by the cutting of young firs which serve for Christmas trees and other decorative purposes. Some hold that this thinning out improves the forests, but the Hon. J. Sterling Morton, Ex-Secretary of Agriculture, states that this is not the case and forests which have not been thinned out for Christmas decorations produce unequaled specimens of the long and straight coniferæ.

We have received Part I, of the 19th Annual Report of the United States Geological Survey and accompanying atlas, consisting of a collection of papers and reports descriptive of the forests of the West, especially of certain of the forest reserves created by executive order on February 22, 1896, prominent among which are Black Hills, Big Horn, Teton, Yellowstone Park, Priest River, Bitter Root, and Washington Reserve Forests. As is usual with all the publications of the Geological Survey, the volumes are handsomely printed and bound.

Incandescent electric lamps have been employed in the laboratory as a source of heat involving the boiling or distilling of volatile inflammable liquids. They are especially applicable for the Soxlet extraction apparatus, a number of bulbs being enclosed in a mantle surrounding the entire apparatus. This admits of perfect regulation of temperature. In order to still further eliminate the danger of explosion the light bulbs may be immersed in the water used for the water bath. Of course the control is perfect and instantaneous.

The Third Assistant Postmaster-General has decided to issue stamps in book form at so small an advance in cost that the public will gladly pay the difference. As is well known large numbers of postage stamps are wasted by sticking together, or to the pocket, so that a stamp book is really a necessity. The books will be of convenient size, and will contain stamps to the amount of 24, 48 and 94 cents. An advance of one cent on each book is all that is to be charged to the public and it is thought that the government will make an excellent profit on the investment.

A bill has been prepared in Colorado which, if passed, will place the granting of marriage licenses in that State in the hands of the board of medical examiners. In each county there is to be a board to consist of three physicians, no two of the same school, and where possible the board is to have one or more female members. Licenses are to be granted to men not less than twenty-five and women not less than twenty-two years. To secure licenses, men and women must be free from certain diseases, and there must be no blood relation between the contracting parties. Should this bill become a law, the towns over the border will probably do a large matrimonial business.

A German novelty consists of India rubber nails for use in places where ordinary nails are liable to corrosion. It is said that they may be driven into soft woods in sizes up to 1 inch long, without boring a hole for their reception. In larger sizes it is necessary to bore holes to start them, and for the largest sizes holes for their entire length. They are said to be very useful in chemical factories, dye houses, breweries, etc., and they are also used in building accumulator cells and other electrical apparatus. It is said that they clinch fairly well. They may be used about explosives where a spark from a nail head when struck by a hammer might prove fatal.

Engineering Notes.

A huge wine-barrel weighing seventy tons has just been built at Nancy for the Paris Exposition. Its cost was $30,000.

Flexible shafting has been put to a new use. It is arranged so as to be attached to a source of motive power for tree trimming.

Letter, copying presses operated by compressed air or hydraulic pressure from local water mains are in use in offices on the Rock Island road.

The production of aluminium in the United States last year, did not greatly exceed that of the previous year when the output was 5,200,000 pounds.

When straightening the curves on the main line of the C. B. & Q. Ry., at Rome, Iowa., a gang of men dug up a bone of a prehistoric mammal of considerable size.

As is well known glycerine is a by-product of soap and candle factories, and something like 40,000 tons of this commodity are made yearly. The South African war has resulted in an increased demand for glycerine.

An acetylene town lighting plant has been installed at Hawes, Yorkshire, England. It was built on a capital of $3,500. There are two large generators, in which the gas is washed by passage through the water. The holder has a capacity of 1,000 cubic feet. About a mile of the mains have thus far been laid.

The New York, New Haven & Hartford Railroad has regulated the publications which are sold on its trains. Certain of them were barred owing to complaints to the railroad company. This is the first case in which we remember a railroad company exerting their undoubted right as a censor in this matter.

In Paris it has been customary for cyclists to go to the nearest restaurant and to inflate their tires with the help of the carbonic acid apparatus, which is used to give a head to the beer, but it is found that a pneumatic tire inflated with carbonic gas soon loses its resiliency and the gas escapes with remarkable rapidity.

Our Consular Agent at Eibenstock, Germany, Mr. Harris, states that in 1890 2,000,000 tons of logs were imported into Germany. In 1898 2,600 tons were imported, or an increase of 30 per cent. During this same period sawed lumber increased from 1,200,000 tons to 2,200,000 tons, or an increase of about 100 per cent. Sawmill owners of the German Empire are beginning to agitate in favor of a higher tariff on sawed lumber.

Artificial sponges are being made in Germany by Dr. Gustav Pum, of Graz. His experiments are based upon the action of zinc chloride solution upon pure cellulose, says The Trade Journal's Review. The resultant product swells enormously with water, but turns to a horn-like substance on drying. In order to retain for the product the property for also absorbing water after drying, alkali-haloids are employed in treating the cellulose with the zinc chloride. The mass after manipulation and molding is said to take the place of sponge in all its uses. It is claimed that a real rubber substitute may come from this field.

A Colorado inventor has recently invented a simple and inexpensive device capable of being attached to any swing door so that during the act of opening the door sufficient power will be stored or accumulated to enable the device to automatically close the door. In brief it consists of a frame which is secured to the inside of the door at the lower swing corner. The wheel is revolved by contact with the floor, and it transmits motion to a shaft to which is secured a spring. This causes a contraction or winding of the spring. When the door is released after having been opened a desired distance, the spring will expand and in expanding will cause the door to close, forcing the wheel to travel in the opposite direction to accomplish this result.

An inventor of Schweinfurt, Bavaria has invented a new machine for the sorting of steel balls according to quality, and it prevents the cracked balls being passed as perfect. Formerly it was tried to sort out the cracked balls (which cannot be avoided even by using the flest quality of steel) by skillful workmen examining each ball by the aid of a magnifying glass. This entails a great deal of work and time, and is after all not reliable as many of the defects cannot be detected by a magnifying glass. The working of the machine is based on purely physical laws, especially the law relating to the rebound of elastic objects. In brief it consists of a cylinder provided with a piston, which moves up and down upon a fixed axle. The balls are placed on the top of this piston and they are raised by mechanical means and are allowed to drop over the edge of the cylinder down an inclined flange. The balls all describe a parabolic trajectory which is practically independent of the condition of the balls. The balls then rebound upon an impact surface and those having the desired degree of elasticity will clear a stop or barrier formed by a ring, while balls which owing to a defect in hardness or homogeneousness having an inferior degree of electricity will, strike, the barrier and fall back into the central space. This is a very ingenious and clever invention.

Electrical Notes.

The St. Louis Hospital at Paris has a new laboratory for electro-therapeutics and radiography.

Electric cars are immensely popular in England, and the equipment companies can hardly keep up with their orders.

Communication has been established between De Aar and Orange River, about seventy miles away, with the aid of kites and wireless telegraphy.

Balloon wireless telegraphic communication is to be attempted at Portsmouth, England, with a view to establishing communication between the sea and a land force.

The principal shell factory of the Boers was entirely destroyed recently by an accidental explosion. It was operated by electricity and the machinery is said to have cost some $400,000.

In one case $266,000 has been saved owing to the establishment of wireless telegraphy between the East Goodwin lightship and the South Foreland. This is denied however, by the elder brethren of Trinity House.

The Metropolitan Street Railway Company, of New York city, has 284 miles of track and last year carried on them 255,835,000 passengers or about half the number carried on all of the steam railroads of the United States.

The house No. 7 West Twenty-second Street, New York city, has been destroyed to make room for a modern building. It was occupied for many years by Professor S. F. B. Morse who died in this house. A marble tablet commemorated the fact that there the great electrician resided.

The electric exhibit at the Paris Exposition bids fair to be one of the most attractive parts of the show. There will be a complete retrospective exhibit of electrical and mechanical apparatus of historical character, and the special exhibit will be housed in the "Court of Honor" built of staff.

It is proposed to construct an electrically worked aerial bridge crossing the Usk, say The English Electrical Review. The width of the river at this point is 240 yards and the time occupied by the carrier going from one bank to the other is estimated at about a minute. The bridge will cost $325,000.

The Milwaukee Electric Railway and Light Company has just let a contract for 300 clocks of the navy lever type for use on the street cars of Milwaukee, says The Street Railway Journal. Conductors will be expected to look after the clocks seeing that they are properly set. It is thought that their use will result in the saving of possible controversies regarding the hours when commutation tickets are available. As the clocks have been in successful use on battleships, it is believed that they will withstand the vibrations of the cars.

According to a German electric journal an association of farmers in Bavaria is building large electrical works which will be devoted to agricultural uses. The current is produced near the village of Schaftersheim, a distance of seven miles. It is supplied partly by steam and partly by water and is sent to the surrounding villages at a pressure of 5,000 volts. Movable motors are used for driving thrashing machines, chaff cutters, bruising mills, etc. The motors are very simple in construction and can be easily handled by the farm hands.

The Grand Rapids, Michigan, Street Railway Company has allowed mail bags to be put on its cars. They are placed at either end of the cars and an opening will be made in the front of the car for slipping letters in the box. In order to permit persons to deposit letters whether they wish to take passage or not, the street car company has given instructions to its motormen to stop at all street corners for that purpose provided that the stoppage does not interfere with schedule time. The post office authorities have arranged, says The Street Railway Journal, to collect the mail, from each car each trip at some point near the post office.

The Alexian Brothers at their hospital in Chicago have an interesting electric light bath, which is essentially a large wooden box, the walls and top of which are lined with mirrors and studded with incandescent lamps. The interior horizontal dimensions of the cabinet are 3½×4½ feet, with a height of about 7 feet. The bottom side walls and the ceilings are lined with rectangular plate glass mirrors, between which are narrow wooden strips with porcelain sockets for the incandescent lamps. In the lower half of the cabinet there are sixty lamps, and in the upper there are thirty-six. The cabinet is carefully insulated to prevent the radiation of heat. The door of the cabinet is in two parts, the lower one being lined with mirrors on the inside and the top one formed of clear glass. The temperature varies from 110° to 140° Fahrenheit, says The Western Electrician, from which we glean our facts. The electric light bath is used for the treatment of nervous diseases, Bright's disease and fatty degeneration of the heart. There are only two similar baths in the country.

TORPEDO PRACTICE AT NEWPORT, R. I.

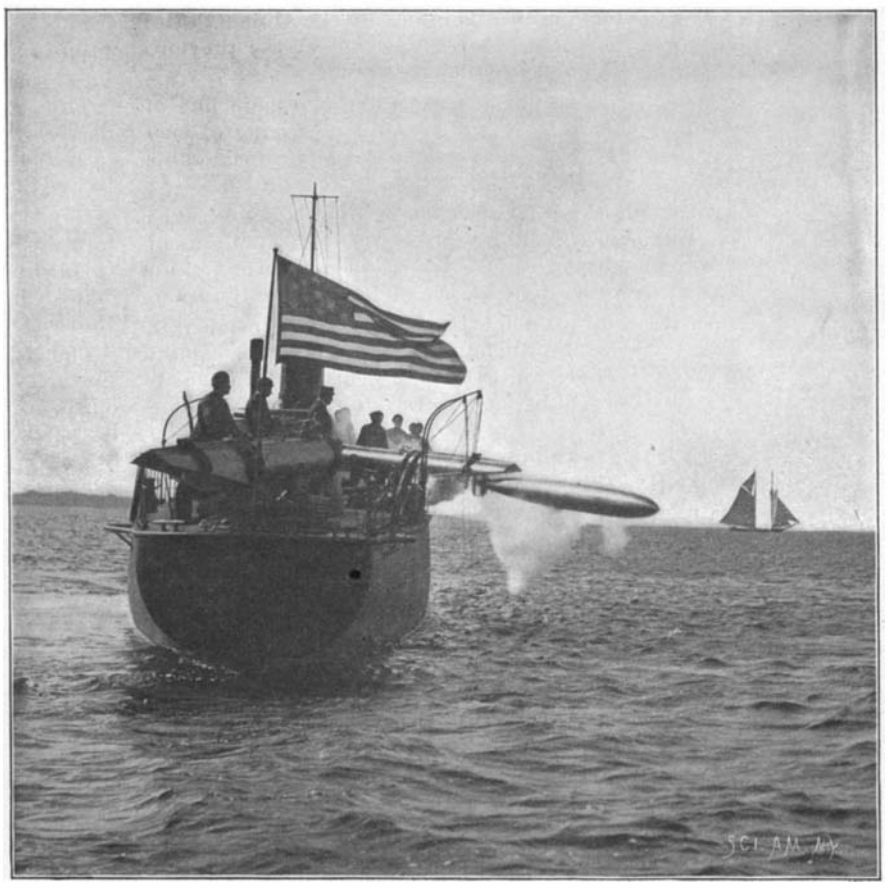
Although torpedo warfare has not yet achieved results at all proportionate to the amount of thought and skill that have been devoted to it, the failure has probably been due more to lack of opportunity or inefficient handling than to any deficiency in the torpedo itself. If we except the abortive attempt of a couple of torpedo boats to get near Admiral Dewey's fleet at Manila, and an equally unsuccessful attack made by one of the Spanish torpedo boat destroyers at San Juan, the torpedo received practically no opportunity during the late war to demonstrate its deadly powers. Whether its moral effect exercised any serious influence on naval operations is open to question. It certainly did not deter our blockading fleet from running in close to the entrance to Santiago harbor during the night. What destructive work was done by the torpedo was wrought upon the enemy by its own weapons, the bow of the "Viscaya" being completely wrecked by the explosion of her forward torpedo room.

At the same time it cannot be said that the events of the war in any was discredited this form of attack or defense, and had the 30-knot destroyers of the Spanish navy been in the hands of American officers and seamen, under similar conditions to those which confronted the Spanish, we think that these little crafts would have given a practical demonstration of their fighting value.

The illustration which we present herewith is one of the best instantaneous photographs of the discharge of a torpedo that has ever come under our notice. The view was taken from astern of the torpedo boat "Morris," just at the instant when she fired an 18-inch Whitehead torpedo from her starboard broadside tube. As most of our readers are aware, a torpedo is nothing more nor less than a small, cigar-shaped submarine vessel, whose interior is divided transversely into six chambers. The first contains a charge of guncotton, which is fired by percussion fuse. The second, which is known as the "secret chamber," contains the pendulum, piston and springs, which maintain the torpedo at its proper level of submersion. The third chamber is the air reservoir, in which is stored the compressed air for driving the engines. The fourth compartment contains the little three-cylinder engine that propels the torpedo. The fifth is known as the "buoyancy chamber" the object of which is to control the trim of the torpedo by the automatic shifting of a piece of lead ballast. The last compartment, which is called the bevel-gear chamber, contains the gear by which the propellers are made to rotate in opposite directions.

The torpedo is "launched" by firing it from a gun in the shape of a cylindrical tube, into which the torpedo is thrust from the rear through a breech mechanism, which is approximately similar to that used in artillery. It is ejected by the explosion of a small charge of gunpowder, which compresses the air surrounding the rear half of the torpedo and thrusts it out of the tube without any serious jar. As it is driven out a catch on the launching tube serves to open the throttle between the compressed air chamber and the engine; and with her propellers revolving at an enormous speed the little submarine craft takes its dive, as shown in our illustration, into the water. When it first enters, the torpedo falls below the normal plane at which it is designed to travel, but the action of the pendulum in the secret chamber throws up a pair of horizontal rudders at the stern and causes the little craft to return towards the surface. The first part of its run is thus made on a wave line which crosses and recrosses the desired and ultimate level of submersion. The piston and the pendulum in the secret chamber gradually bring the torpedo to its true course.

Commonly the United States torpedoes carry three discharges; one on either beam and another astern. The starboard and the astern launching tubes will be noticed in the illustration.



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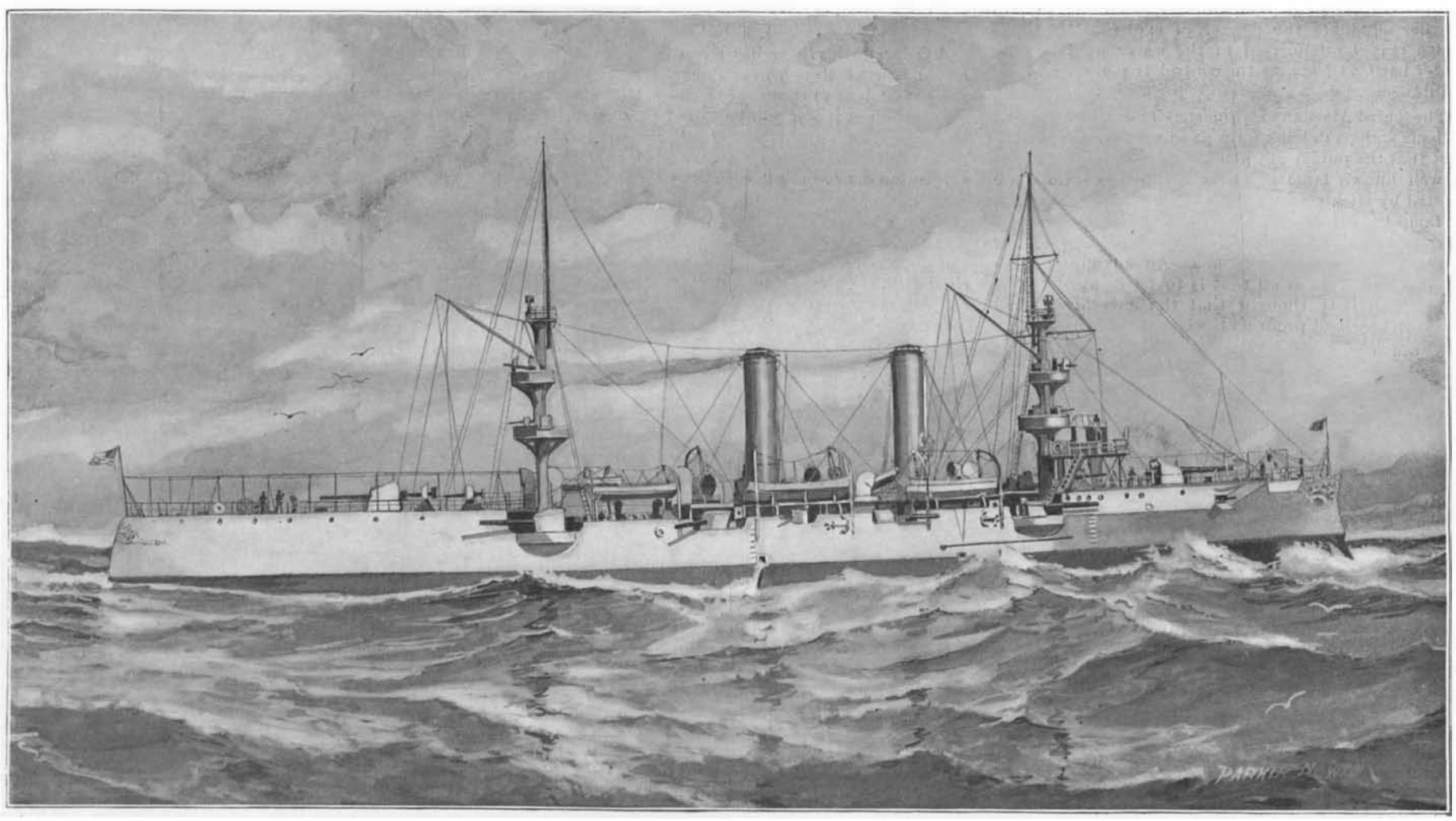
TORPEDO PRACTICE AT NEWPORT, R. I.—LAUNCHING AN 18-INCH WHITEHEAD TORPEDO FROM THE TORPEDO-BOAT "MORRIS."

OUR LATEST PROTECTED CRUISER, THE "ALBANY."

It will be remembered that during the rush of naval and military preparations in the days immediately preceding the Spanish-American war, the representative of our navy in Europe succeeded in purchasing two protected cruisers which were under construction at the Armstrongs for the Brazilian Navy, and were known as the "Amazonas" and the "Abreu." Of these the "Amazonas" was practically completed, and with very little delay her name was changed to "New Orleans," the American flag was hoisted, and the ship set sail for New York. After a few slight changes at the New York Navy Yard she set sail in time to take an active part in the operations of the war. The other vessel, whose name was changed to "Albany," has recently been completed and may be looked for any day on this side of the Atlantic.

The "Albany" in all essential points is an exact duplicate of the "New Orleans," the changes which have been made in her being "such," in the language of one of our naval constructors, "as were absolutely necessary to render her habitable for Anglo-Saxons." The alterations have been chiefly in the living quarters of the officers and crew, some of them being necessary to meet the differences in climate between the tropics and our more northerly latitudes, and others being necessitated by the fact that the accommodations, sanitary and otherwise, which seemed to have sufficed for the South American republic would have been absolutely unendurable for the men of the American navy. An improved system of ventilation has been installed, the officers' quarters have been rearranged and enlarged, and additional berthing space has been provided for the crew. Considerable alterations have also been made in the dynamo room. These modifications have been carried through without in any way impairing the fighting efficiency of the vessel.

The "Albany" was launched at Newcastle, January



THE ENGLISH-BUILT PROTECTED CRUISER "ALBANY," SOON TO ARRIVE IN THIS COUNTRY.

Displacement, 3,700 tons. **Speed,** 20·73 knots. **Maximum Coal Supply,** 800 tons. **Complement,** 365. **Armor:** Protective deck, 1¼ inches on flat, 3 inches on slopes; shields, 4 inches. **Armament:** Main battery, six 6-inch rapid-fire, four 4·7-inch rapid-fire; secondary battery, ten 6-pounders, eight 1-pounders, two Colts. **Date,** 1899.

14, 1899. She is 330 feet in length over all, with a beam of 43 feet 9 inches, and a maximum draft of 15 feet 10 inches, and her displacement, according to figures furnished by her builders, is 3,402 tons with ammunition, stores, coal and water half consumed, and with all ammunition, stores, coal and water on board, 3,954 tons. She is driven by twin engines and screws; her maximum indicated horse power is 7,500, and her speed, as determined in recent trials in England under the official representative of our navy, was 20.73 knots for four hours under forced draft and 19·3 knots on a run of six consecutive hours under natural draft. The vessel is sheathed and coppered and will, therefore, be especially suited for service in tropical waters.

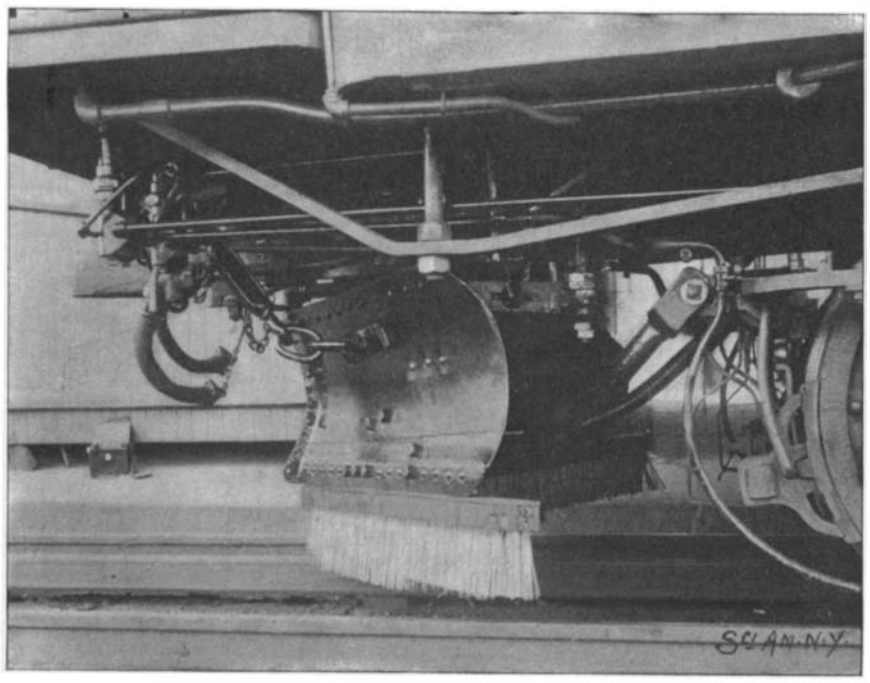
The "Albany" is thoroughly representative of the latest trend of ideas in the construction of protected cruisers. Like the best of her type she is distinguished by her good speed, generous coal capacity, considerable length in proportion to beam, enabling her lines to be carried out with great fineness and beauty, and by her powerful armament and her ability to deliver great energy of fire through a widely extended zone. In respect of defensive qualities, however, like all protected cruisers, she is certainly weak and open to attack. She is entirely devoid of vertical side armor, and her protection against the entrance of projectiles into the vitals consists merely of a curved deck of steel assisted by coal bunkers in the wake of the engines and boilers at the water line.

Although the "Albany" is about as good a representative of her class as exists in the world to-day, the class, as such, is somewhat discredited, the present tendency being to build larger cruisers and give them a belt of vertical armor at the water line.

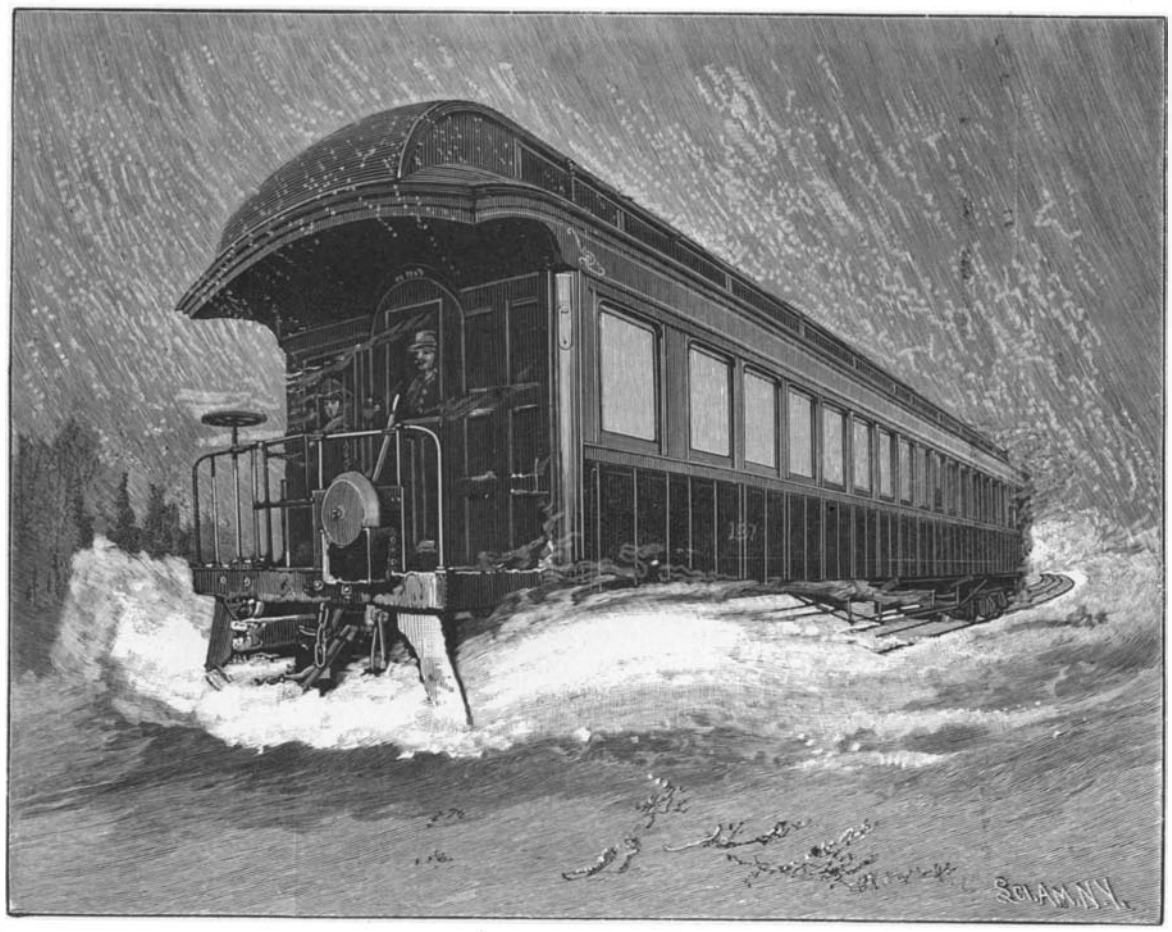
The main battery of the "Albany" is made up of six 6-inch and four 4·7-inch rapid-fire guns, and the secondary battery consists of ten 6-pounder rapid-fire guns, eight 1-pounders, and two Colts. The whole of the main battery is of the long 50-caliber type, manufactured by the builders of the vessel. The disposition of the battery is as follows: One 6-inch gun is carried on the forecastle deck, another aft on the poop, and four others are carried in sponsons on the main deck in the waist of the vessel, two of the latter being forward on either beam, and two aft. The sides of the vessel are cut away so as to allow these four guns on the main deck to be fired directly forward or astern parallel with the axis of the ship. The 4·7-inch guns are carried in broadsides on the main deck between the 6-inch guns. The battery of 6-pounders is carried on the main deck, forecastle and poop, two of these being in the bow, two in the waist, and two astern on the main deck, while the other four are carried on the forecastle and the poop. The vessel is provided with two military masts upon which there are no less than four separate fighting-tops in which are distributed the 1-pounders and Colts. The arrangement of the battery enables the vessel to concentrate the fire of three 6-inch guns dead ahead and astern, while the broadside fire consists of four 6-inch and two 4·7-inch guns.

The 6-inch gun of the "New Orleans" is carried in a trunnion sleeve or seating, in which it slides. It is held in the forward or loading position by coiled springs, inclosed in two cylinders which are attached to the seating. Attached to the gun are two pistons which travel in the cylinders, the latter being filled with glycerine, and it is the combined resistance of the springs and of this glycerine to the movement of the pistons which serves to take up the recoil. After the recoil the gun is returned to the loading position by the action of the coiled springs, which were compressed during the recoil. The breech of the gun and the crew are protected by a large shield of 4-inch Harvey steel. This type of gun has fired seven rounds in 61 seconds, and the 4·7-inch gun has a record of five rounds in 22 seconds. The 6-inch gun fires a 100-pound projectile with a muzzle velocity of 2,600 foot-seconds and a muzzle energy of 4,687 foot-seconds. This is equal to a penetration of 20½ inches of iron at the muzzle. The 4·7-inch guns have the same velocity, and a muzzle energy of 2,109 foot-tons with a penetration of iron at the muzzle of 15½ inches. At 2,500 yards the velocity of the 6-inch and 4·7 inch guns is 1,790 and 1,558 foot-seconds, respectively, the energy at that distance being in the 6-inch gun 2,224 foot-tons, and for the 4·7 inch guns 757 foot-tons.

For protection the "Albany" relies mainly upon a curved deck, which is 1¼ inches on the flat and 3 inches in thickness on the slopes, the latter extending along the sides from the flat deck, which is slightly above the water line, to a junction with the sides of the vessel several feet below the water line. This protection is reinforced by the large coal bunkers, which are extended along the berth deck on either side amidships, and present a horizontal thickness on each side of 8 feet of coal. The normal coal capacity is 512 tons and the bunker capacity, with full stowage, is about 800 tons.



ELECTRIC CAR SNOW-PLOW AND RAIL-BRUSH EQUIPMENT.



CLEARING SNOW FROM A THIRD-RAIL TRACK.

The Scientific American in Germany and Austria.

One of our exchanges of Vienna has favored us with a large bunch of clippings from German and Austrian papers which have reprinted articles from the SCIENTIFIC AMERICAN. The variety and reputation of these papers makes the compliment very gratifying including as they do The Hamburger Nachtrichton, Wiener Zeitung (Vienna), The Neue Freie Presse (Vienna), Deutsche Zeitung (Vienna), Triester Zeitung, The Frankfurter Journal, The Neues Wiener Journal (Vienna), The Berliner Local-Anziger, The Breslauer Zeitung (Breslau), The Linzer Tagespost (Linz), The Hamburgischer Correspondant, The Reichswehr (Vienna), The Merauer Zeitung, and many others.

FIGHTING SNOW ON THE THIRD-RAIL.

Since the advent of the electrically-propelled passenger car, deriving its motive current from an auxiliary third rail, it has solved the problem of a frequent rapid transit suburban service; one of the first difficulties which was encountered was that of keeping the third-rail clear in snowy weather, so that the connecting shoe of the car would make a good electrical contact. If this were not assured, however rapidly one might travel in good weather, he would not be certain of reaching his destination on time should a heavy snowfall occur.

The New York, New Haven, and Hartford Railroad Company, who were the first to adopt the third-rail system on their suburban lines, have had in operation for the past two winters a combination snow-plow and sweeper that has operated very successfully and kept the rail clear in the stormiest winter weather. As will be clearly seen from the smaller illustration, the arrangement consists simply of a small plow similiar to those used on locomotives, which is fastened to the car truck by two curved arms and chained to the end sill of the car by a few links of heavy chain. Attached to the bottom of the plow is a heavy bristle brush of like contour with it, and reaching to the top of the third-rail, which, if there is but a light snow, it effectually sweeps.

It is not only in light snowfalls, however, that the brush is effective, for it acts equally well in drifts or in several feet of snow on the level. During the heaviest storm in 1898-9 winter the cars were kept running on the Hartford, Conn.—Middletown and Berlin — Middletown lines long after the main steam lines in the State were blocked, and the lines could have been held open through the entire storm if the cars had been kept running, frequently through the night, as was done all day.

All this seems to prove the effectiveness of this simple arrangement and to show that motor cars, when properly equipped and frequently run, are much more efficient in preventing snow blockades than an occasional train hauled by a modern powerful locomotive.

The Roentgen Rays as a Depilatory.

Dr. Neville Wood records, in The London Lancet, a case in which a considerable overgrowth of hair on a woman's face was removed by applying the Roentgen rays. There were ten sittings per week of ten minutes each, the face and neck being protected with a lead-foil mask, except where the rays were intended to act. The distance between the anti-cathode and the skin was between 6 and 7 inches. The current of the primary coil was maintained at about five amperes, and the number of interruptions varied between 250 and 300 per second. After fourteen exposures, it was noticed that the darker hairs had lost some of their luster, and in a week's time there was an obvious lessening in their number. The hairs became brittle and pale in color, with atrophic bulbs. There was a slight reddening of the skin during this period. After forty-five exposures, the whole of a very thick, downy and hairy growth had disappeared, except nine hairs, which remained at least a week after the total removal of the others. They were found, however, to be readily separated at the bulbs, being retained in position by a more superficial part of the root-sheath. After cessation of the treatment, only a few thick hairs had returned, and these were removed with the well-known process of destroying them by the electric needle. Dr. Wood is of the opinion that the treatment is neither disfiguring nor painful, and thinks that about twenty will clear the ground for the use of the electric needle, and that between thirty or forty exposures will probably result in permanent alopecia.

THE Baltimore and Ohio Railroad is to use electrical locomotives on a 17-mile grade up the Allegheny Mountains. They will assist the ordinary locomotives in pulling the heavy freight trains up the steep grade.

Correspondence.

A Denial from Mr. Maxim.

To the Editor of the Scientific American:

I have noticed in the daily papers many advertisements of liquid air.

I have been consulted by the organizers of the Tripler Liquid Air Company concerning the application of liquid air to the manufacture of explosives, and at their request wrote them a letter on the subject; but further than that, I have not been consulted, and am in no way responsible for the claims for liquid air which are now being advertised. Hudson Maxim.

New York, March 1, 1900.

A Confirmed Habit.

To the Editor of the Scientific American:

Enclosed please find P. O. for a year's subscription to the Scientific American commencing with the year. I have tried to do without it, but have come to the conclusion that it is impossible to lead a Christian life and hope for peace and advancement in life to come without subscribing for the Scientific American. I remember when it was first published, and a couple of years ago I saw No. 1, which was in strong contrast with what it is now. Lewis Swift, Director.

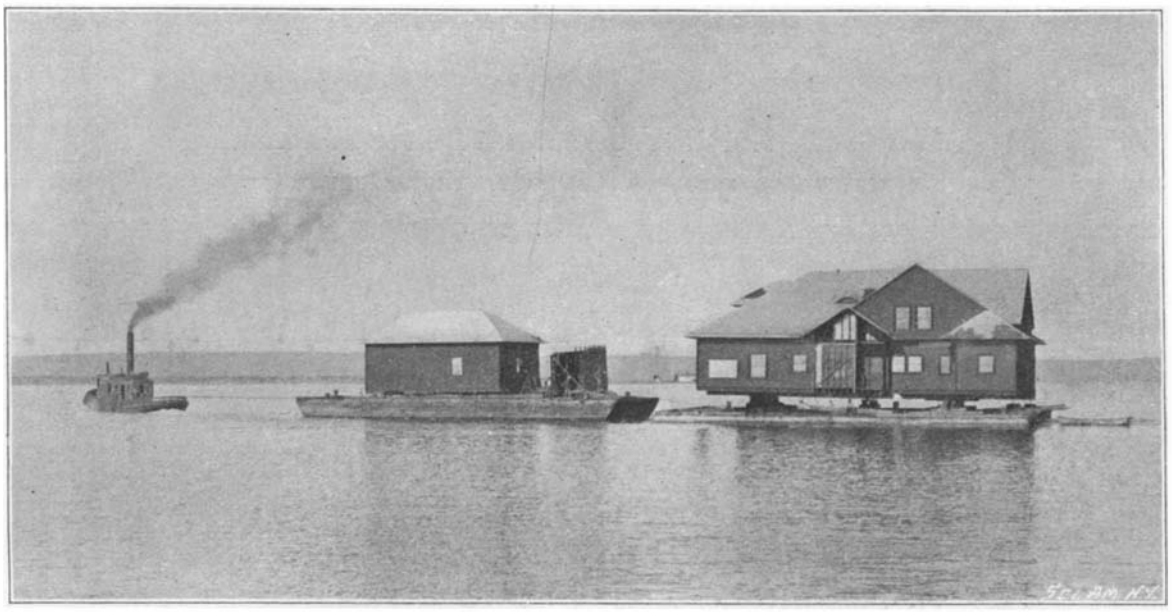
Lowe Observatory, Echo Mountain, Cal., U. S. A., January 18, 1900.

TRANSPORTATION OF BUILDINGS BY WATER.

Our illustration from a photograph shows an unusual, yet simple method of transporting buildings which occasionally is resorted to where great distances are involved. Moving a house by sea is so uncommon that when Dr. William A. Edwards had his residence and barn taken from San Diego, Cal., across the bay on floats, a voyage of over a mile and a half, it attracted much attention.

The buildings were first moved to the shore close to the water's edge; then at high tide the floats shown in the illustration were floated as closely as possible to the buildings. At low tide the buildings were moved upon their floating foundations and at high water were easily floated and towed to their destination without difficulty or accident, the waters of the bay at the time being calm and smooth.

Operations of this character have to be conducted under the most favorable conditions, otherwise a strong wind or heavy waves would greatly interfere with the success of the undertaking. Usually early in the morning is the time selected.



NOVEL METHOD OF HOUSE MOVING, SAN DIEGO BAY, CALIFORNIA.

A Photographic Search for an Intermercurial Planet.

It is a fact capable of demonstration, that the faintness of a star that may be photographed with a given instrument, against a bright background of sky depends, within certain limits, directly on the length of the focus of the lens, and is independent of its aperture.

In the Harvard Observatory Annals, vol. xviii, p. 104, it was shown that if the place in which to look for the Pole Star is known, that three minutes after it first becomes visible to the naked eye in the evening, the light of the sky in its immediate vicinity is of about the same photographic intensity as that of the sky surrounding the sun at the time of a total solar eclipse.

Starting with these two fundamental facts, a series of experiments has been undertaken with a photographic lens having an aperture of 3 inches, and a focal length of 11 feet 4 inches. The curves adopted were those employed in an ordinary landscape lens, and it was found that the field was large enough to cover nine 8×10 photographic plates arranged in three rows of three each. This result was only obtained, however, by attaching the plates to the interior of a concave surface of double curvature, and thus obtaining a curved field.

By giving an exposure of one minute in the region of the pole, with this instrument, three minutes after the Pole Star first became visible, it was found that the light of the sky was sufficient to darken the plate appreciably, but not so much as to prevent stars of the eighth magnitude appearing with sufficient intensity to be found by a careful search, in the large part of the field of view.

Three similar lenses have now been ordered, and the four will be placed upon one mounting, in such a manner as to photograph a region extending for sixteen degrees on either side of the sun, and having a breadth of ten degrees throughout its length. Throughout nineteen degrees of its length every portion of the region will appear upon two separate plates.

The satellites of Mars, Jupiter and Saturn all revolve very nearly in the equatorial planes of their primaries, and in the same manner Mercury revolves very nearly in the equatorial plane of the sun, which is inclined about seven degrees to the plane of the ecliptic. It is, therefore, reasonable to suppose that bodies still nearer to the sun would revolve in the same plane. It so happens that the earth passes through this plane about one week after the date of the solar eclipse of next May, so that there is a strong probability that if an intermercurial planet exists, it will appear somewhere upon the narrow line forming the projection of this plane upon the celestial sphere. It will be seen, therefore, that the date of this eclipse is especially favorable for the proposed search.

We have very good evidence, from the visual observations hitherto made, that no intermercurial planet brighter than the third or fourth magnitude exists. We possess no evidence whatever for or against the existence of fainter bodies in this region having sufficient size to be properly called planets. We are reasonably certain that the immediate vicinity of the sun is filled with countless bodies of such size as to be properly described as meteors.

If we assume that at its average brightness, Mercury is of the first magnitude, and that the albedo of an intermercurial planet is the same as that of Mercury, we shall find that at the distance of Mercury from the sun, a body of the eighth magnitude would be 120 miles in diameter. If its distance from the sun was but one-half as great, its diameter would be 60 miles, and if but one-quarter as great, or 9,000,000 miles, it would be 30 miles in diameter. Judging by the analogous case of Jupiter, the existence of such a small planet is quite possible.

Should such a body exist, and should it appear upon the plates, which it is proposed to expose somewhere in the State of Alabama, we should still be entirely at a loss to compute the orbit, or to determine the distance of the body from the sun. If, however, other photographs of it should be obtained with a similar apparatus, in Spain or Algeria, we should then be enabled to compute an approximate orbit, based on the assumption that it moved in a circular path. It might then be found again at the following eclipse, which occurs a year later, and a more accurate elliptical orbit could be computed for it. While it is desirable that the duplicate apparatus should also be furnished with four lenses, this is not necessary, and in case the planet should be found upon our plates, two lenses, one photographing the region on each side of the sun, would be all that would be necessary to independently make the discovery, and furnish the elements necessary to compute the circular orbit. It is in the hope of inducing some European observer to supply himself with this apparatus, that the present article has been written.

The foregoing plan appears to be of sufficient importance to justify aid from the observatory. Preparations have, therefore, been made to give it a careful trial. It is hoped that this early publication may permit similar observations to be made at a second station sufficiently distant to reduce the danger of failure from clouds, and if an intermercurial planet should be found, to furnish an approximate determination of the form of its orbit.

Edward C. Pickering, Professor of Astronomy.
Havard College Observatory, February 13, 1900.

An important deposit of good lignite has been discovered in Russia.

The Report of the Librarian of Congress.

The report of Herbert Putnam, the new librarian of Congress, has just come to hand, and shows that the library is in excellent condition. The expenditures for the year ending June 30, 1899, was $159.854.81; there was $58,267 earned by the copyright business. The total expense of the copyright business was $40,272.38, leaving a net balance of profit of $17,944. The care and maintenance of the building amounted to $86,395. The total force, including the Superintendent of Buildings and Grounds, consists of ninety-nine persons. The report of the librarian for the year ending July 30, 1898, contains an enumeration of the library with the following totals: In the general collection there are 705,122 books, in addition to 226,972 pamphlets. There are also 126,985 duplicate copyright deposits which cannot be considered as part of the collection proper. The accessions during the year have been very gratifying; the total on June 30, 1899, included 957,056 books and pamphlets.

During the period from September 1, 1898, to June 30, 1899, the additions to the manuscript department comprised 1,866 manuscripts. The superintendent of this department went to Porto Rico in search of manuscript material, and incidentally of local imprints. The visit to San Juan resulted in transferring to the Library of Congress practically the entire accumulation of archives in the palace of the Governor-General. The shipment arrived in 220 cases. The manuscript department now contains many interesting rarities. During the year there were catalogued three volumes of Paul Jones' papers, including 259 manuscripts, and there have been calendared of the Washington papers 839 manuscripts. The number of manuscripts in the department is about 25,500; so far only 7,340 have been catalogued, and only 1,604 have been calendared. Two employes from the Government printing office have been at work on the repairing of manuscripts. Seven hundred and fifty have been repaired and 36 volumes of the Loyalist papers have been prepared for binding. Seven hundred and eighty of 1,049 bound volumes are in need of rebinding, and there are 210 packages of original manuscripts and 900 transcripts still unbound. The total number of maps and charts is 52,181, and the work of indexing the maps has progressed in spite of the inadequate force. Various bibliographies have been prepared or are in preparation. One of them will be a list of the maps in the library of Congress relating to the Revolutionary War, and a list of those relating to the city of Boston. The larger list of maps relating to America in books now forms a document of eighteen hundred typewritten pages, which will later be offered for publication under authority of Congress. The number of pieces of music now in the Department, including duplicates, amounts to 277,465. The total number of prints in the collection is now stated to be 70,823. The reading-room of the library has been frequented by 121,270 persons, the largest number being on February 4, 1899, when there were 962, and the smallest number on a half-holiday, when there were 41 readers. The number of books and periodicals supplied was 297,662. The reading-room for the blind is opened every day from nine to four, and from October to July there have been on each afternoon except Wednesdays readings, and on every Wednesday musical recitals. The readers and musicians are volunteers. During the year it has been visited by 31,000 persons, of which 7,025 have attended the readings and recitals. The number of blind in the District of Columbia is, of course, limited, so the importance of a library of this type lies not so much in the persons directly reached as in the demonstration that it offers. The whole library is now in regular receipt of 3,641 periodicals.

Death of Leander J. McCormick.

Leander J. McCormick, an inventor of harvesting machinery, died at Chicago, February 20. He was born in Virginia in 1819, and became associated with his father in the reaper manufacturing industry at an early age. In 1847, he engaged in the manufacture of reapers with his brother at Cincinnati, and in 1848 went to Chicago where he superintended the manufacture of the machinery. He made many improvements in the machine which made his family famous. In 1871, he presented an observatory together with a 24-inch refracting telescope to the University of Virginia.

A CHEMICAL GROWTH.

BY GUSTAVE MICHAUD, D.SC.

A curious experiment which any one can perform at the cost of a few cents is herewith explained and represented:

Buy one ounce of liquid sodium amalgam, a sheet of aluminium costing a few cents, and about six inches of stout copper wire. With a file sharpen one end of the copper wire, so as to give it the shape of a pencil. Rub off the surface of the aluminium plate with a knife just before beginning the experiment.

Dip the pointed end of the wire into the amalgam, and, after removing it covered with the liquid alloy, write or draw on the aluminium plate. Dip your wire into the amalgam from time to time, just as if you were writing with pen and ink. Never mind the fact that your ink is a metal, your pen a metal, your tablet a metal, and that your pen seems to write nothing but a few scratches on your tablet. Finish your work and then watch and see what happens.

The lines just traced by your pen will suddenly assume a dull, whitish tint, contrasting with the brightness of the metal. Then they will rise above the metallic surface at the rate of about one inch an hour. In less than five minutes your drawing will be in strong relief. You may wipe out the white substance which has thus sprung from the metal, it will develop again with the same vigor, as would some kind of mushroom gifted with the rather abnormal property of thriving on metallic ground.

These white formations consists principally of alumina. The cause of their growth is the formation of an amalgam of aluminium, in which that metal is in a molecular state altogether different from that in which it exists in its coherent form. Although mercury has less affinity for oxygen than aluminium, as soon as an alloy of the two metals is made, aluminium loses its previous chemical inertia and undergoes a slow combustion, the product of which is alumina.

Sodium plays no direct part in the reaction, yet without it, I found it difficult to get the mercury to adhere to the aluminium. Sodium facilitates also the adhesion of mercury to the copper wire. The best results are obtained in damp weather. If the air is dry at the moment of the experiment, results just as good will be obtained by breathing gently from time to time on the drawing, so as to slightly moisten the amalgam of aluminium.

1.—A CHEMICAL GROWTH—FIVE MINUTES AFTER WRITING.

2.—HALF HOUR AFTER WRITING.

3.—A FEAT IN HALF-TONE—THE ORIGINAL PHOTOGRAPH.

4.—ORIGINAL PHOTOGRAPH BEFORE MANIPULATION.

A FEAT IN HALF-TONE WORK.

The editor is frequently supplied with good matter accompanied by such poor illustrations as to render the article, as a whole, unavailable for publication. In such cases he occasionally invokes the aid of the photo-engraver whose skill enables him to present a creditable half-tone from a poor photograph. A case in point is the article on the "Chemical Growth" found on this page. In this case the illustrations which present so satisfactory an appearance were made from the same negatives used for the illustrations accompanying this article. It can be seen in the annexed cuts, that the photograph was printed with the idea of bringing out to the best advantage the words "SCIENTIFIC AMERICAN" which illustrates the phenomenon described in the experiment, the face of the child and the other details being sacrificed to this main feature. This illustration was prepared from the author's photograph, and is a faithful reproduction of the original as it appeared when placed in the editor's hands. To an emphatic "that won't do" from the editor, the photo-engraver answered by sending in the plates accompanying the article on the "Chemical Growth." The defects in the original photographs were due to the fact that the subject was unevenly lighted, producing too great contrast, in other words very extreme high lights on one side and correspondingly deep shadows on the other. In order to procure a plate that would be admissible to the columns of the paper it was necessary to overcome this defect by reducing the intensity of the light portions of the photograph and lightening the portions in deep shadow.

With his work thus mapped out for him the photo-engraver first procured the original negatives; then by means of aniline coloring matter, which was put on the reverse or glass side of the negatives over the clear portions which produce in the photograph the deep shadows, he increased the actinic density of the negatives in their shadow portions and was thereby enabled to produce prints in which there was less contrast between light and shade, bringing out details that were entirely missing in the dark portions of the original photographs. This operation caused the words "SCIENTIFIC AMERICAN" to fade away until they were too faint for reproduction. The parts of the original photos in which the aluminium plate with the raised lettering were reproduced with the required depth of tone, were then cut out and neatly pasted over the same parts of the new photographs. Then the half-tones were made with the results shown. The results clearly justify the pains that were taken, and it will be of interest to those who have made a study of such work to know that the plate was not "touched up" but that the hair of the little girl, the texture of the wall paper, and the fabric of the table cover are all brought out by manipulating the original negative in the manner described and that the artist's brush was not made use of except for the purpose of modifying the shadows of the negative.

The Work of the Division of Botany of the Department of Agriculture.

The Division of Botany of the Department of Agriculture is performing a most valuable work. The many deaths of human beings and farm animals caused by poisonous plants justify continued work by the division. During the fiscal year ending June 30, 1899, 67 cases of poisoning were investigated, 41 pertaining to man and 26 to farm stock. The fatalities included over four thousand head of farm animals and at least twenty-one persons. The death rate of human beings in the United States from poisonous plants is twice as great as the average death rate in England from the same cause. This is unquestionably due to a lack of proper knowledge about poisonous plants. This is supplied by Bulletin No. 20 entitled "Principal Poisonous Plants of the United States."

Under the authority of the law authorizing the Secretary of Agriculture to purchase seeds in the open market, test them at his discretion, to publish the result of the tests including the names of the dealers, several hundred tests were made and the delinquents were notified by letter, and it remains to be seen if they will mend their ways. Trial grounds for seeds are located at Kensington, Md. The work of seed and plant introduction has been attached to the division of botany in order to avoid multiplicity of supervision. During the last year explorers have been sent to Russia to secure superior varieties of cereals resistant to cold, draft, and fungous diseases. A specialist has been sent to Japan to secure a variety of rice suitable for cultivation under the new system developed in Southwestern Louisiana, in particular a high-milling quality as described in SCIENTIFIC AMERICAN SUPPLEMENT No. 1257. Another expert investigated the agriculture of the Mediterranean region and secured a stock of fig-fertilizing insects for the Division of Entomology as is also described in SUPPLEMENT No. 1257. Others visited South America and other points.

A testing garden has been secured on the Potomac flats, through the courtesy of the War Department, where observation may be had of plants introduced from foreign countries. There is wide-spread interest in the economic plants of the tropics and in tropical agriculture. The botanist of the division is Frederick V. Coville, Esq.

THE owner of a coal tract near Pittsburg is building a model mining town with a view to supplying 3,000 workmen with all possible benefits at a minimum of expense. The houses will be built only of brick or stone, and will stand on a quarter-acre lot, with flower-beds and hedge in front. It is arranged that the houses shall be owned by the individual miners when they can pay for them, and the miners are to run the village themselves, and the stores are to be managed on the profit-sharing plan. Several model industrial towns have been built, but they have always been managed on the paternal system which has usually ended in failure.

The Current Supplement.

The current SUPPLEMENT No. 1262 has a number of articles of remarkable interest. "The Arrow Point Spearheads of Prehistoric Times" is a brief review of a paper contributed by Prof. Thomas Wilson to the report of the United States National Museum. The "Cruise of the 'Albatross'" is Prof. Agassiz's third letter from the "Albatross" to the Hon. George M. Bowers, United States Fish Commissioner of Fish and Fisheries. "The Increasing Productiveness of Labor, the Result of Invention" is by Francis H. Richards. "Santa Ana Canal," describes an important engineering work and is fully illustrated. "Are Further Experiments Needed for Determining the Atomic Weight of Oxygen" is by Prof. Edward W. Morley. "The Origination of Printing Types by Photographic Methods" is by Thomas Bolas. "Working Drawings of an Electric Cab" deals with the carriage portion of an electric carriage of the latest style. "Pictures Produced on Photographic Plates in the Dark" is by Prof. William James Russell, Ph.D.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

COTTON-SEED PLANTER.—JAMES P. CALDWELL, Winnsborough, S. C. The machine is of that class employed for planting cotton-seed at regular distances apart and in uniform quantities, so as to avoid the necessity of chopping out the rows of cotton-plants after the plant has grown. The invention is an improvement upon a similar apparatus devised by the inventor and is so constructed that the seed will be better agitated in the hopper and more positively fed to the seed-drop wheel. The seed-drop wheel is provided with integral pockets and with an improved means for locking pistons in the pockets, so that any number of pockets may be closed for any length of time. A single drive-belt actuates the stirrers and the seed-drop wheel.

Bicycle-Appliances.

SUPPORT AND LOCKING-DEVICE FOR BICYCLES.—SHANKER ABOJI BHISE, Bombay, India. This invention provides a very ingenious means for supporting a bicycle when not in use and for locking it when thus supported. The invention furthermore provides a means for operating the supporting and locking mechanism automatically. It is claimed that the support can be applied to any bicycle without injuring the frame. The improvements can be profitably used as a support for a bicycle indoors, as well as on the road, and thus dispense with a special stand for the bicycle. The device can be easily removed and taken to pieces for necessary repairs.

Engineering-Improvements.

STEAM-BOILER.—MAURICE A. COOKE, Nashville, Tenn. The boiler is of the porcupine type, and is composed of an outer and inner shell joined at their lower ends to form an annular water-space. A central tube closed at its lower end depends from the top of the inner shell, the tube being provided with radial tubes having horizontal partitions causing a more efficient circulation of the water. A return pipe leads from the bottom of the tube and extends outside of the shells; and an outgoing pipe leads from the annular space between the shells. The boiler is cheap and is not liable to leakage due to expansion and contraction of its parts. The porcupine tubes catch all the soot; and the flames in passing among the tubes burn the soot, so that tubes need not be scraped.

Mechanical Devices.

DOOR-CLOSER.—JAMES E. MCFEELY, Pueblo, Colo. The object of the invention is to provide a simple and inexpensive device which can be attached to any swing-door and which during the opening of the door, stores up sufficient power to close the door automatically. The device consists essentially of an incased wheel which is attached to the door and which winds up a spring as the door is opened. As the door is released, the relaxation of the spring will close the door.

AUTOMATIC STOP FOR MILLS.—ALEXANDER S. MARTIN, Willard, Ga. The invention provides a device for stopping water mills when the supply of material to be ground runs out. A tripping-shaft has one end movable transversely of the shaft's axis. A crank-arm is mounted on the movable end. The power-shaft has an arm adapted to engage the crank-arm, when the tripping-shaft is at one end of its transverse movement. The tripping-shaft and catch are connected; and a band or cord holds the tripping-shaft away from the power-shaft. In the feed-hopper a band lies as a loop and is engaged by the grain flowing therethrough to hold the tripping-shaft disengaged. When the grain ceases to flow, the grinding-mechanism is automatically stopped by the release of the tripping-shaft and the closing of the gate.

MANIFOLDING-MACHINE.—CHARLES LOHRMAN, Brooklyn, New York city. The inventor has devised a simple and compact machine upon which bills, invoices, and other memoranda can be simultaneously produced in triplicate upon a single sheet. The machine is so constructed that the folded machine to be written upon can be quickly placed in position and removed without injury, and that the ribbon-carrying spools are readily accessible and adjustable from the exterior.

BOBBIN-MAKING MACHINE. — ALEXANDER M. GRIMOND and JAMES CRIGHTON, 29 Rose Street, Dundee, Scotland. This invention is a machine for making or forming bobbins from blanks or comparatively rough pieces of wood in a more simple and expeditious manner than has hitherto been possible. The gist of the invention is found in suitably assembling and arranging in one machine the necessary parts for boring and turning or similarly forming the bobbins at one operation or handling.

WIRE-FENCE MACHINE.—JAMES K. THOMA, Winfield, Kans. The machine is provided with means for the independent manipulation of any one of the wires required in the construction of a fence and for the bearing engagement of the machine with a convenient fence-post. On the frame of the machine a winding apparatus is mounted, connected with a clamp serving to engage and haul the wire. The wire-reel is carried on the frame, permitting the wire to be paid out as the machine advances along the fence-line. The clamp and winding devices serve to haul and stretch the wire.

Railway-Appliances.

BRAKE.—WILLIAM F TREXLER, Allentown, Penn. The brake is designed for use upon ordinary vehicles as well as upon railway and tramway cars, and is arranged to brake the rotating part without much exertion on the part of the operator. A cable is wound several times about the shaft; and on the shaft a brake-shoe, constructed of independent sections, is loosely mounted. The sections have spiral grooves on their peripheries, in which grooves the cable is secured. The sections are of such number that some of them will lie alongside of others when the cable is wound on the shaft, whereby tension on the cable will bind the sections and force them laterally against each other.

CAR-BRAKE.— FRANK S. SNYDER, Newburg, N. Y. The car-brake is provided with a wheel-shoe having a limited movement in a casing. A rail-shoe moves the wheel-shoe into frictional contact with the car-wheel. The rail-shoe is actuated to apply the wheel-shoe and is itself subsequently applied to the rail. A valved sanding-device is carried by the rail-shoe and is adapted to open when the rail-shoe moves toward the rail.

FLAGSTAFF.—GEORGE R. CLIFFORD, Vancouver, Canada. Fault has been found with the ordinary form of railway flag which is planted by workmen along the track, because the flag hangs in folds around the staff and does not lie out in position to be clearly observed. To overcome this disadvantage, the inventor suspends the flag, being suspended, from an arm projecting laterally from the staff. When the flag is not in use the arm is permitted to fall down beside the staff.

Miscellaneous Inventions.

GARMENT-FORM.—ELLA M. SCHRADER, Seattle, Wash. The dress-former is made of a rubber cover which, when filled with air, conforms with the shape of the garment to be made. Upon the cover a restrainer or lining, made according to measurements, is fitted. When fully expanded, the cover causes the restrainer to assume the form desired, hence rendering it unnecessary to fit the garments upon the person. The former is collapsible and takes up but little room when not in use.

FRAMING-JOINT.—EDWARD E. SQUIRES, Seattle, Wash. The framing-joint, for use in the making of doors and the like, has one member formed with a tenon and with copings. The tenon is reduced at the base; and the other member is formed with a longitudinal groove shaped to correspond with the tenon and provided with clamping-jaws at the outer sides of the groove. The jaws are adapted to lock over the tenon; and the copings are arranged to engage the clamping-jaws.

ACETYLENE-GAS GENERATOR. — CHARLES C. STEWART and GEORGE C. UPDEGRAFF, Hutchinson, Kans. This invention is an improved generator of that class in which the carbid is discharged in small quantities into an excess of water. The apparatus comprises a water-sealed gasometer-bell and generator-tank into which the carbid is automatically discharged by mechanism operated by the rising and falling of the gasometer. The carbid-feeding device is provided with a feed-operating lever actuated as the gasometer falls by an arm pivoted to the gasometer-bell. Stops limit the drop of the arm relatively to the bell; and a fixed stop engages the arm to check its fall and free it, as it is moved by the continued fall of the bell.

ACETYLENE-GAS MACHINE.—JAMES WALTON, Phœnicia, N. Y. The gas-machine has a water-tank in which a generator-cylinder is vertically movable. A jacket is carried by and surrounds the cylinder. A discharge-pipe leads from the upper portion of the cylinder to a point near the lower end of the cylinder. Another discharge-pipe receives the gas from the first-named pipe; and a water-chamber in the lower portion of the water-tank receives the discharge of the last-named pipe. There are no pressure-actuated valves. An excess of gas-pressure is automatically relieved and discharged into the outer atmosphere.

GASOMETER. — JAMES WALTON, Phœnicia, N. Y. This gasometer is provided with ingenious means for preventing an explosion when the pressure is excessive. A stationary pipe extends upwardly from the top of the bell and has a port below its closed end. When the bell rises above a predetermined height, the port is uncovered and the excess gas allowed to escape. When the pressure is relieved, the bell falls, and the port is covered. The gasometer is particularly serviceable in acetylene-machines and is applicable to the generator described in the foregoing notice, patented by the same inventor.

AUTOMATIC CUT-OFF AND FILTER —MARCELLUS M. HITT, Luray, Va. The rain which first falls from a roof carries along with it much dirt, whereby it is rendered unfit for drinking. On a water-tank or receptacle a pivoted cut-off is mounted and a filter is arranged comprising inclined conductors. The intermediate filter-section has a discharge-slot in its bottom. The filter-section is counterbalanced by a water-receptacle also having a discharge-slot in its bottom. The apparatus constitutes an efficient automatic cut-off for the first dirty-water and an equally efficient filter for the clean water following the first wash. The device readjusts itself automatically after every operation.

GRATE FOR ZINC-FURNACES.—JOHN D. JAMES, Pulaski, Va. The inventor has provided a new form of grate-bar and devised a method of operation, which not only relieves the workmen from the influence of the heat, but also so changes the nature of the clinkers that they are no longer hard and vitreous, but are maintained in the spongy, frangible nature in which they are formed. They are hence easily disintegrated and removed. The grate is constantly suffused on its upper surface with a rapidly-evaporating film or spray of water, the influence of which extends in the form of a spray to a lower stratum of coke and the clinkers. A great reduction of temperature is obtained; and the clinkers are changed as described.

WAGON-BRAKE.—SEPTIMUS T. WILLIAMS, Beaver Dam, Ky. A brake-bar is arranged to rotate upon its axis and is connected with a fixed part of the wagon-frame by a rope or chain in such a manner that upon rotating the bar, the chain is wound up and the bar thereby brought into contact with the wheel. The particular form of brake devised by the inventor relieves the hounds and coupling-pole of all strain, in which important respect the invention differs from others of like nature.

CARTRIDGE-BELT.—DR. EDWARD T. GIBSON, U. S. A., Fort Meade, S. D. In the cartridge-belts, of the kind now in use in our army, the web tubes when new retain the cartridges fairly well; but soon they expand, and the cartridges are no longer securely held. The new style of cartridge, by constant removal and replacement, hastens this expansion more than the old style. To avoid the necessity of modifying all the belts now in use, Dr. Gibson has devised a simple wire frame which can be attached to the belt and which holds the cartridge in place. No special instruments are required; any soldier can apply the holder to his belt.

TUBE OR FLUE-CUTTER.—ISIDOR J. B. HANTEN and JOHN J. KRANZ, Watertown, S. D. This invention is an improvement in tube-cutters for cutting off boiler-tubes. A hollow stock has near its outer end a threaded bearing. Tong-like arms are pivoted within the stock at a point between their ends and have their outer ends provided with cutters arranged to operate when their inner ends are spread apart. A spreading-wedge operates between the inner ends of the arms; and a shaft is threaded in the bearing of the stock and arranged to spread the arms.

MACHINE FOR SORTING STEEL BALLS.—FRIEDRICH SCHUNK, Schweinfurt, Bavaria, Germany. Cracked and defective steel balls have hitherto been separated from the good by means of a magnifying glass—a process most laborious and tedious. Sometimes the cracks are so fine that they cannot be detected even by the aid of the glass, so that often defective balls have been inadvertently used in bicycle bearings. To obviate this difficulty, the inventor causes the balls to fall upon a steel ring surrounded by an adjustable barrier. The good balls will bound over the barrier, the bad balls will fall back.

PAPER-HOLDER. — HENRY TENDICK, Manitowoc, Wis. This device holds paper of various sizes, particularly paper used for wrapping packages in stores. The device can be slid in and out relatively to the counter to which it is attached, thus not only making it convenient for a salesman quickly and readily to secure any desired sheet of paper, but keeping the paper clean and in good condition and preventing the waste which occurs when the paper is left loose or in piles on a counter. A cord-holder is used in connection with the device and also a sponge-holder, so that the fingers can be moistened in order more firmly to grasp the paper.

COPYING-PRESS. — ALBERTO POBLETE Y GARIN, Salamanca, Chile. This invention provides a contrivance which will enable the operator to exert a uniform pressure, so as to secure a perfect copy. The inventor inserts a wedge-shaped, pneumatic cushion between the leaves of a book, which cushion receives and transmits the applied pressure. An increase in the size of the surface to which the pressure is to be applied will necessitate only an increase in the dimensions of the cushion, but will not necessitate an increase in the pressure to be applied, since the pressure is transmitted undiminished to all parts of the cushion, whatever its size.

GAME-APPARATUS.—JOSEPH H. ELLER, Lexington, Ohio. The apparatus is an attachment for pool-tables, and the game to be played is in the nature of bagatelle. In playing the game a cue is used. A large measure of skill is involved, since cushion-shots must be made.

BASKET FOR PACKING FRUIT.—AUSTIN B. CULVER, Westfield, N. Y. In this basket the usual cover hooks or wires are dispensed with; and the handle is so placed with relation to the body and the cover, and the cover is so related to the handle, that one will serve as a lock to the other. The handle can be sprung without a tendency to loosen its fastenings and without detriment to the body of the basket. When the handle is depressed or sprung, the cover will be released so that it can be partially or wholly removed, enabling the fruit to be conveniently inspected.

TRACE-HOLDER FOR SINGLETREES.—LAWRENCE M. CAMPAU, 123 E. Congress Street, Detroit, Mich. The singletree is provided with a recess designed to receive the trace, which recess, when the singleteee is passed through the eye of the trace, is covered by the holder. When the holder is carried to retaining position, the recess is exposed and automatically receives the trace. By this means a double hold is provided for the trace, the recess and the holding device coacting to retain the trace in position.

SNAP-HOOK.—JACOB E. VANNOTE, Lakota, N. D. The invention provides a simple form of snap-hook, which can be used in connection with harness to attach the driving-reins or a hitching-strap to the rings of a bridle-bit. The snap-hook is constructed so that no springs are necessary and so that the snap automatically locks and does not accidentally unlock while in use.

SCAFFOLD OR PORTABLE TRESTLE.—THOMAS MILNE, Sandon, British Columbia, Canada. This extension or adjustable scaffold is designed for the use of carpenters, plasterers, bricklayers, and other house mechanics. The scaffold is adapted for adjustment, and hence for extension or contraction vertically and horizontally. A special feature of the invention is the adaptation of the parts of the trestle for detachment; another is the provision and peculiar construction of metal castings for holding and connecting the various wooden portions or bars composing the frame proper of the scaffold or trestle. Special castings hold the planks laid on the scaffold or tresle.

CLOAK OR SKIRT RACK.—ADOLPH GREENSPAN, Bowling Green, Ky. The display rack is designed to display coats, cloaks or skirts, and is extensible, laterally so as to accommodate garments of all ordinary sizes. The cloaks and skirts are hung on a rotary frame secured to opposing stub-spindles, with which disks turn. The disks are spring-pressed into engagement with the standard, so as to lock the frame.

APPARATUS FOR USE IN WRITING.—BENJAMIN F. ROBINSON, Margaret, W. Va. This invention provides means by which motions of large scope can be reduced so that the muscles can have a large movement or sweep in forming the letters or characters, the letters or characters being inscribed on a reduced scale. The inventor believes that motions of large scope are more conducive to muscular development and general health than more delicate motions.

ACETYLENE-GAS MACHINE.—CHARLES E. ROSS, Lincoln, Neb. The machine can be used for both portable and stationary lighting, in which the weight of the water is used to keep a sufficient pressure on the gas and automatically moisten the carbid to maintain a proper volume of gas. The machine is very simple and is not provided with any derangeable automatic valves or levers.

CHOKE-BORE FORMING DEVICE.—ALFRED G. ADELMAN, Boise, Idaho. The device is intended to be used by gunsmiths for all gages of breech-loading guns in which the "choke" has been shot out or become what is termed "scatter-gun." No metal is removed from the barrel, as with inside boring tools. The device is especially applicable to guns chemically-treated to prevent rusting. The device is portable, and is adjustable to all gages and lengths of breech-loading barrels.

Designs.

HOOK.—JAMES B. CAROLIN, Newark, N. J. The hook is designed to be used in connection with hosiery supporters, and is characterized by the cheapness and simplicity of its construction.

PAPER-BOX BLANK.—GEORGE A. COLGAN, Brooklyn, New York city. When folded this blank forms a box which is exceptionally strong and durable.

NETTING.—SOLOMON M. BLOCH, Manhattan, New York city. The netting is a veil for ladies, embellished by cob-web ornaments.

GAME-BOARD.—JAMES A. VARNUM, Boston, Mass., and ALBERT C. WARREN, New London, Conn. Within the octagon board is arranged a border forming a cross; and in the cross are a number of squares alternating in color; while perforations are located at the corners of the squares.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC.

ESTIMATING FRAME AND BRICK HOUSES. By F. T. Hodgson. New York: David Williams Company. 1899. 16mo. Pp. 147. Price $1.

An eminently practical book for the builder. The author writes with authority and he shows an appreciation of precisely the information desired by builders and young architects.

CONSUMPTION AND CHRONIC DISEASES. By Emmet Densmore, M.D. Brooklyn: The Stillman Publishing Company. 1899. 16mo. Pp. 198. Price $1.25.

The present volume deals with a hygienic cure at patient's home of incipient and advanced cases. It is a popular exposition of the "open-air treatment" with latest developments and improvements. The method seems to be a common sense one although we cannot pronounce upon the merits of medical treatments.

THE PRACTICAL ENGINEER POCKET BOOK FOR 1900. Manchester, England. 1900. 24mo. Pp. 438. Full leather, gilt. Price 60 cents.

We have already commented upon the cheapness of English pocket books for engineers. The one before us is an admirable book and will be useful in any office or drawing-room where calculations are being carried on. The tables are of special value to mechanical engineers and their selection is admirable.

MULHALL-HARPER COMPARATIVE STATISTICAL TABLES AND CHARTS OF THE COMMERCE OF THE WORLD. Compiled by William Harper. Philadelphia: Commercial Museum. 1899. Tables and colored plates.

The Chief of the Bureau of Information of the Philadelphia Commercial Museum has compiled a very significant series of tables accompanied by graphic representations which show in an adequate and easily understood manner the wonderful growth of the commerce of the world for the last seventy years. The commerce of the United States naturally receives full attention.

THE GENESIS OF PETROLEUM AND ASPHALTUM IN CALIFORNIA. By A. S. Cooper, State Geologist. Sacramento. 1899. Pp. 89.

An excellent discussion of this subject by a competent authority.

POPULAR STAIRBUILDER AND CARPENTER'S HAND BOOK. By William Peoples. New York: David Williams Company. 16mo. Pp. 260, 52 plates, full leather. Price $2.50.

It embraces carpenter's and stairbuilder's geometry, problems, conic sections, cylindric sections as applied in the construction of the wreath-post of hand-rail, rules for the measurements of surfaces, the construction of ladders, box stairs, roofing, etc. It is a useful book and the form is compact.

THE CORNICE WORKERS' MANUAL. By Sidney P. Johnston. Chicago: The American Artisan. 1900. 12mo. Pp. 234. Price $3.50.

Any volume on metal plate work which will tend to economize the labor of the worker in sheet metal will, we are sure, be appreciated by all practical men. The work before us is thoroughly adapted for its purpose. Some of the illustrations might have been on a larger scale as at present the figures are very trying to the eyes.

WILLIAMS' PORTFOLIO OF PLANS. Designed and published by Charles H. Williams, Architect, Pardeville, Wis.

CORN TRADE AND OPTIONS MARKET CONSIDERED IN RELATION TO SOCIAL ECONOMIC PROBLEMS. By F. Hammesfahr. New York: G. E. Stechert. 1899. Pp. 106. Price 50 cents.

HOUSES FOR THE COUNTRY AND SUBURB. By William Dewsnap, 150 Nassau Street, New York, Quarto. Pp. 36. Price $1.

COMPOUND ENGINES. By James Tribe. Racine, Wis. 1899. 18mo. Pp. 137. Full leather, flexible. Price $1.50.

The principal portion of this treatise first appeared at various times in a technical paper and the articles were received with so much favor that the author has collected them and has added to and revised the matter so as to make a valuable little book dealing in an eminently practical way with a rather difficult subject. The explanations are very practical and the higher mathematics are eschewed.

Business and Personal.

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Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Metal Novelties wanted. Bliss Metal Co., Prov., R. I.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7833) J. P. O. writes: I am about to construct a motor and battery about ¼ horse power. Would you please give me some instructions? A. If you wish to build a motor and battery, you should find the plans of the sort of machine you want, study these thoroughly and follow them carefully. Do not change them in any way. You cannot improve them, and any change you may make will be for the worse. We can recommend the motor and battery described in Parkhurst's "Motor Building for Amateurs," which we can furnish you for $1 by mail.

(7834) J. S. C. asks: 1. In making the induction coil in SUPPLEMENT, No. 160, where can I get the vulcanite cylinder or the vulcanite to make it with? A. Vulcanite can be purchased at any electrical supply store. Ask for hard rubber. The copper bars are of half their real size in the drawings. They may be of almost any size if stiff enough to close it tightly against the commutator. 2. How large do the copper bars L M have to be, and will it work without the commutator and the condenser? If so, how differently will it have to be made? A. A commutator is very desirable in order to reverse the current. A condenser is necessary if you wish the coil to give any spark. 3. Where can I get the Grenet battery cells for it? A. You do not need Grenet cells, a bichromate cell, such as is described in SUPPLEMENT, No. 792, price 10 cents, will be better than the old Grenet. Both use the same materials.

(7835) W. E. G. writes: I read of a preparation for mildew-proofing sails and think it was in one of the SCIENTIFIC AMERICANS. Can you advise me which one it was in, also if it discolors the sail in any way. A. Saturate the cloth in a hot solution of soap (¼ pound to a gallon of water); wring out and digest it for twelve hours in solution of ½ pound alum to 1 gallon of water. Treatment with strong aqueous solution of alum or lead acetate answers very well.

(7836) T. B. asks: What horse power engine will it require to melt a piece of iron weighing 10 pounds by electricity and the use of electrodes, say in two or three minutes time? This is merely an example. If it could not be done in that time give me your best idea? A. Theoretically about 40 horse power would be required if there were no loss of heat at all. We cannot tell any nearer than that since it is not stated in what shape the iron is nor what its resistance is. Practically more than this should be provided, since loss by radiation will be considered.

(7837) W. P. R. asks: Would there be any sound if there were no ears to hear it? A. The word "sound" has two senses. One is the sensation in the ear which produces hearing. In thissense there is no sound where there is no ear. The other sense is the regular vibration of matter which would produce a sensation in an ear. This exists whether there is an ear to receive it or not. The word is thus used for both the cause and its effect on the senses of man.

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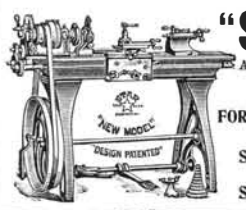

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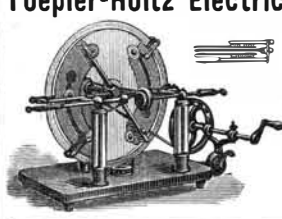

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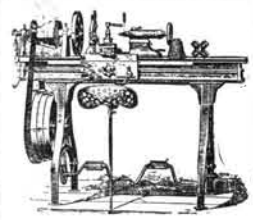

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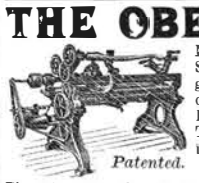

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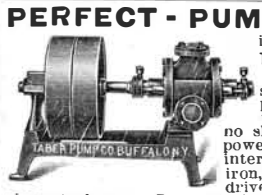

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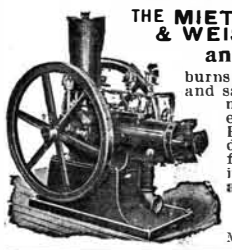

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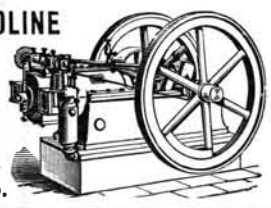

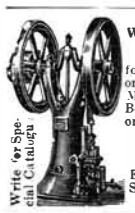

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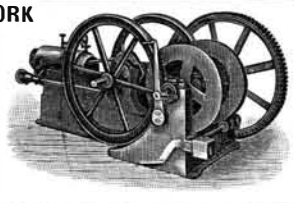

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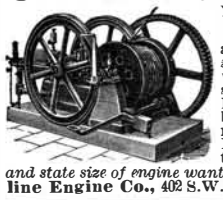
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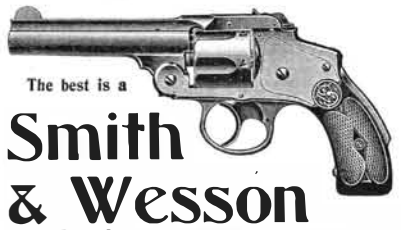

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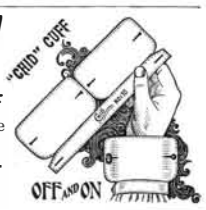

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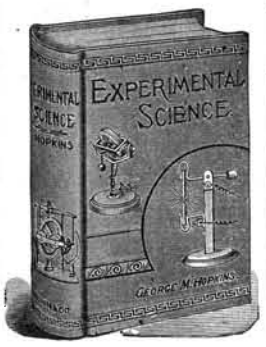

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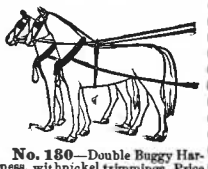

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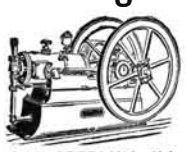

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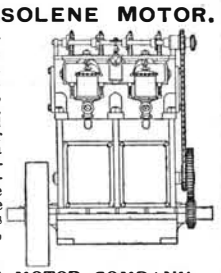

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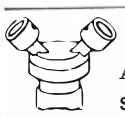

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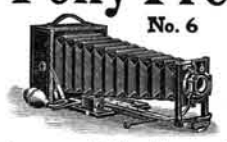

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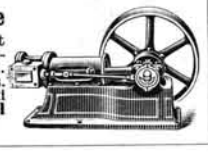

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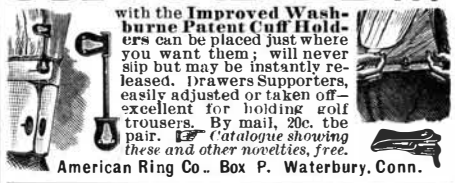

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